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ANALYSIS OF MILITARY
ORGANIZATIONAL EFFECTIVENESS
(AMORE)

USER'S MANUAL

APRIL 1981

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The Analysis of Military Organizational Effectiveness (AMORE) methodology provides a means for the analysis of unit response to degradation and its recovery of capability over time. The methodology considers both the personnel and equipment of the organization. The interaction of these elements to form teams which contribute to organizational capability is also treated. Following a simulated degradation of the organization, reorganization is accomplished to achieve the maximum capability in the minimum time. The capability, as a function of time following degradation, is provided by exercising the software. Additional data is provided for a detailed analysis of the

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20. ABSTRACT (Cont.)

organizations weaknesses as well as its strengths. This manual is intended to give the analyst/user a basic understanding of the methodology, the unit analysis, and development of input for the software. Details of the software are provided in the companion Programmer's Manual.

PREFACE

The purpose of this manual is to provide users with information on the fundamental concepts of the Analysis of Military ORganizational Effectiveness (AMORE) methodology, the associated computer software, and the operational procedures required for its use. The methodology was developed as a means to examine the ability of military units to reconstitute capability as a function of time after experiencing degradation of personnel and/or materiel. This manual is directed toward those users who desire to employ the AMORE methodology as an analysis tool.

This manual has three chapters. Chapter 1 briefly discusses military organizational assessment and the AMORE methodology. Definitions of terms used throughout the manual are included in this Chapter. Chapter 2 addresses the AMORE computer model. It contains the information needed by the organizational analyst to develop input data for the AMORE model. This chapter also discusses the model output. Chapter 3 contains the technical information (card formats, variable names, etc.) needed to enter the input data into a computer.

The methodology discussed in this manual is applicable for use with a number of computer systems. Each computer system has certain unique procedures which must be followed in order to successfully process the AMORE program. The procedures in this manual and in the companion Programmer's Manual are directed specifically to the UNIVAC 1100 system.

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CHAPTER 1

THE AMORE METHODOLOGY

1.1 INTRODUCTION

The purpose of the Analysis of Military Organizational Effectiveness (AMORE) methodology is to assess military unit capability as a function of time after suffering losses of assets. The methodology combines in-depth analysis of the unit's functions with a computer model to characterize the response over time of the unit to a simulated attack or other degradation. Not only does the AMORE methodology avoid the pitfalls which plague other methodologies, but it provides an improved measure of effectiveness for military organizations.

Most methods for quantifying unit combat effectiveness rely almost exclusively on attrition counts. These methods determine the number of personnel or items of materiel affected by some degrading mechanism (e.g., conventional or nuclear munitions, peacetime readiness shortfalls) and then use the counts to assess the resultant effectiveness of the unit. Usually, some level of personnel attrition (e.g., thirty percent) is judged adequate to either defeat the target or to result in some level of remaining capability. In some instances, a level of materiel degradation is employed, while in others, both personnel and materiel levels of attrition are recorded and the analyst is usually left with the task of somehow judging what that all means. Even when both materiel and personnel counts are considered together, they are rarely combined logically in a manner which leads to a credible measure of the unit's overall effectiveness.

Furthermore, equating attrition counts with capability levels ignores the fact that unit effectiveness is a function of time. Usually,

a military unit can increase capability after attack by reorganizing its remaining resources. Failure to consider unit reconstitution leads to an inaccurate measure of unit effectiveness.

Figure 1-1 shows graphically the inadequacy of using attrition counts to measure effectiveness. In this figure, different unit responses are compared by plotting unit capability as a function of time. Figure 1-1 clearly illustrates that different units inflicted with the same level of damage (attrition count) behave quite differently. Some units are impacted much more than others initially; moreover, different units recover to different levels and do so at quite different rates. The added dimension of the AMORE measure of effectiveness highlights many more facets of a unit's capability. It is clear that the results and conclusions obtained through the use of AMORE will often differ in significant ways from those obtained by simply measuring unit attrition.

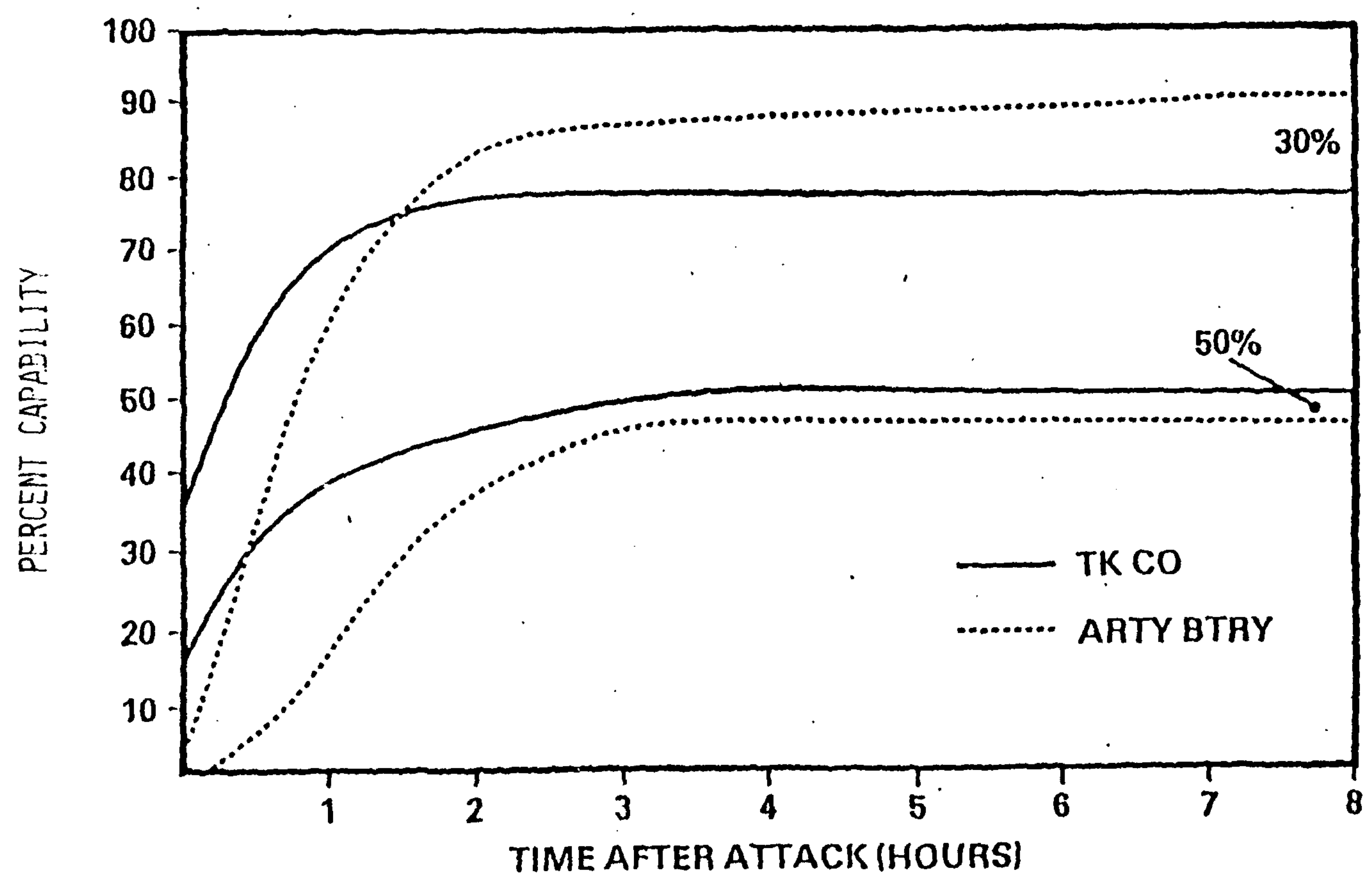
The AMORE approach was conceived and designed specifically to deal with the deficiencies described above. Accordingly, the method possesses the following features:

- Assesses the joint effect of personnel casualties and materiel damage upon the organization.
- Measures effectiveness as a function of time after the initial degradation.

1.2 AMORE METHODOLOGY OVERVIEW

The AMORE methodology provides a detailed analysis of an organization. When using the methodology, organizational analysts study the unit and its missions in order to incorporate both in the measurement of unit capability. The unit capability measurements obtained through the AMORE methodology are realistic measures of

RESPONSE TO SAME LEVEL OF PERSONNEL INCAPACITATION*



*WITH ASSOCIATED EQUIPMENT DAMAGE

Figure 1-1. Unit Response Comparison

effectiveness for organizations which consider the interaction of personnel and equipment over time. The methodology requires identification of the functions which are needed in order to accomplish the mission. Personnel and materiel needed to perform each function are divided into teams. Teams are constructed with the assets needed for various levels of unit operational capability, and thus represent fractions of unit capability. These teams are then reduced to essential teams by stripping them of any people or equipment which are not absolutely necessary for mission accomplishment.

Once the essential teams for the unit and mission under consideration have been established, the unit is degraded and unit reorganization begins. People and equipment who can adequately perform in other jobs (when given time to come up to speed at the task) are reassigned to those jobs so that the unit can quickly come as close to its pre-degradation level of capability as possible. The number of essential teams available to the unit at selected times during the reorganization process provides a measure of capability at those times.

An outline of the AMORE methodology is shown graphically in Figure 1-2. The following text addresses this figure. The box numbers referred to in the text are the numbers in parenthesis in the figure.

The first step in exercising the AMORE methodology is the definition of the mission/posture combination (Box 1). The choice of mission is fundamental to the establishment of essential teams (a result of the functional analysis, Box 2) and the posture is crucial when establishing Probabiltiy of Degradation (PD) sets (Box 3). Often in practice, a unit is studied in a variety of mission/posture combinations by use of multiple sets of team requirements.

The functional analysis (Box 2) is a detailed study of both the unit TOE (or other organizational representation) and the unit

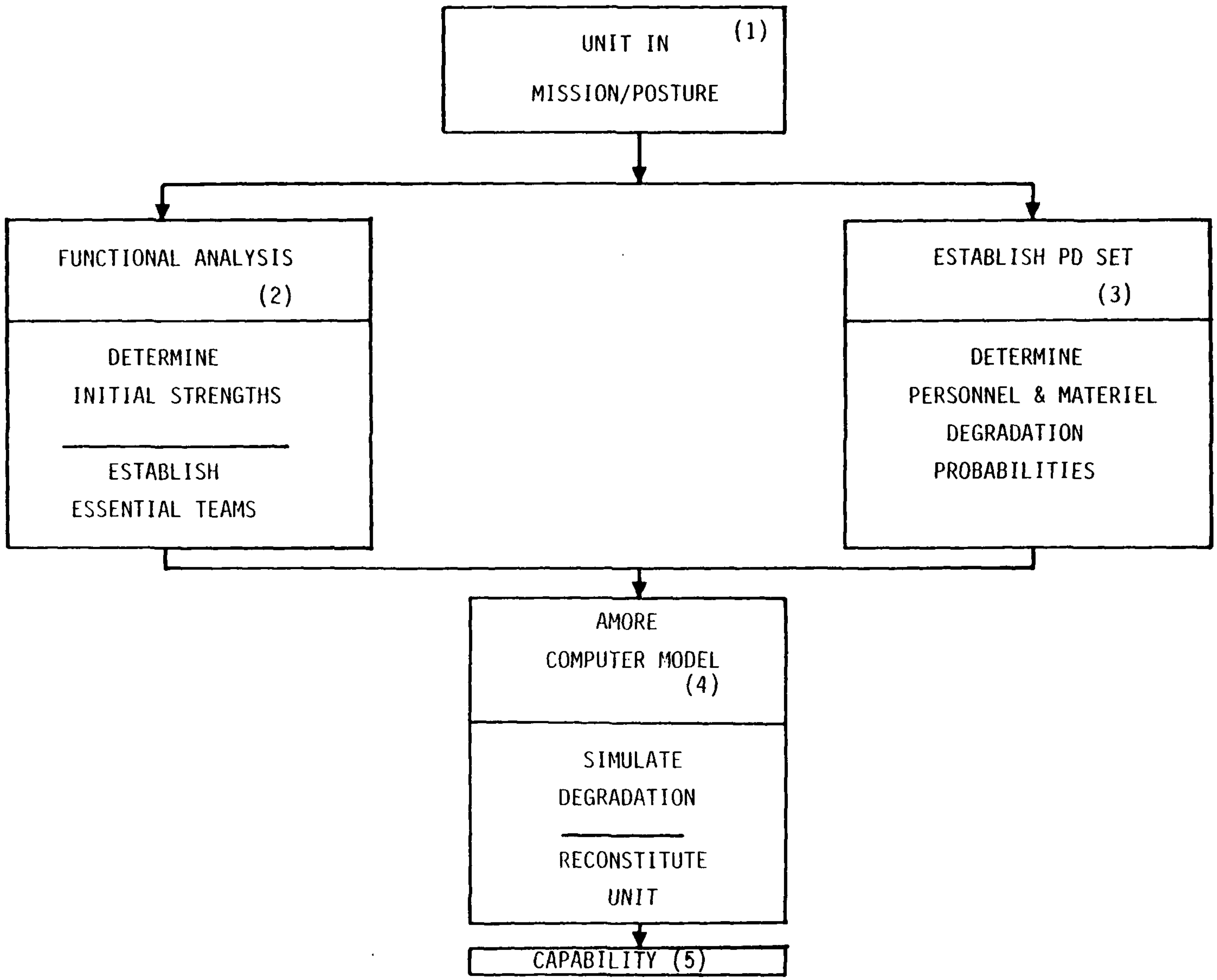


Figure 1-2. AMORE Methodology

mission. Initially, the functions required by the mission are identified and the initial strengths of personnel and materiel required by the TOE are specified. One of the objectives of the functional analysis is to relate the assets of the unit to the functions required by the mission. The assets are then partitioned into teams, i.e., increments of capability, each of which contribute to mission accomplishment.

The analyst must examine each of the teams and establish which of the personnel and equipments in that team are absolutely essential for mission accomplishment. Thus, as a hypothetical example, the crew of an artillery battery might consist of a half-a-dozen personnel, but only four are actually essential for combat operation. This minimum complement of personnel serves to define a "bare bones" element. The "bare bones" elements are called essential teams. Note that each essential team is comprised of both personnel and associated items of equipment required to perform some portion of the mission.

Simultaneous with the examination of the organization's anatomy and its dissection into teams is the determination of probabilities of degradation for personnel and materiel (Box 3). The effect of the degrading mechanism on a unit with the assumed mission and posture must be evaluated to determine the personnel and materiel degradation probabilties. These effects may vary between personnel skill groups and equipment types due to inherent differences in personnel postures and equipment vulnerabilities. A variety of methodologies may be used for the evaluation. The universally accepted Joint Munitions Effectiveness Manual (JMEM) methodologies are commonly used to establish probabilities of degradation from simulated attacks.

This information is input to the AMORE computer model (Box 4). The model simulates both the degradation of the unit (subject to the PD's input) and the post-degradation regrouping of personnel and materiel into the maximum number of essential teams (according to the

requirements, Box 2). The degradation is assessed using a Monte Carlo technique and the input probabilities. Regrouping, or reconstitution, requires a knowledge of which of the individuals in the unit can be used or substituted for various skills, and also which items of equipment are substitutable for other items. Further, when substitutions are feasible, one must also consider the time required for a decision to substitute and the time it takes to effect a substitution. In the case of personnel, one must also consider the time it will take a replacement to come up to speed in performing the new task. These and many other pertinent times are all considered so that the gradual build-up of unit effectiveness becomes expressible as a function of time.

The problem of unit reorganization becomes one of making optimal personnel and materiel assignments based on the available substitutions to fulfill the commander's objective. A transportation algorithm is used because of the supply and demand nature of the problem, as well as the requirement that all assignments be integral. Following degradation, some of the teams have lost essential team members and are no longer capable of performing their mission. The number of teams which remain operational is the measure of the unit's initial capability. Increasing capability requires the reorganization and reconstitution of essential teams. Thus, regrouping of personnel and materiel to maximize the number of essential teams is one of the commander's main objectives. Another objective is to minimize the average time required to reach maximum capability.

The teams which are reconstituted in time represent the recovery of capability by the unit. The stochastic processes used by the model necessitate the evaluation of multiple iterations of the process. Results for all iterations are averaged to develop an expected value of unit capability (Box 5) for the defined mission(s) and the simulated degradation. Figure 1-1 is typical of the results

obtained,showing unit capability as a function of time,and illustrates the differences of unit types and their response to the same level of degradation.

The AMORE software is designed to provide other information in addition to capability as a function of time. The model will identify those personnel skills and equipment items which precluded additional increases in unit capability. Further, the assignments which were made in order to achieve the capability levels output are tracked and may be output for analysis. Thus, AMORE provides data for an in-depth analysis of the weaknesses, and the strengths, of a unit.

The AMORE methodology provides a measure of an organizations capability considering the organization as a system of both personnel and equipment interacting over time. The methodology is sensitive to:

- Differences in degrading effects
- The specific capabilities of individual personnel and equipment items
- The interaction of the personnel and equipment to form teams which contribute to organizational capability.

1.3 DEFINITION OF TERMS

Assignment Matrices	An AMORE program option.
Ref: Sections 2.1.2.4 2.2.4.5 2.3.3.3	This option processes and prints assignment matrices, which contain the average over all iterations of the optimal allocation of resources.
Capability	Capability is the fraction of total essential teams that a unit is able to reconstitute within some time following degradation. Capability is calculated and output for times specified by input.
Ref: Sections 2.1.1.3 2.3.2.2	

Choke Analysis

Ref: Sections 2.1.2.2
2.2.4.3
2.3.3.1

An AMORE program option.

This option determines the personnel skills and equipment items which would be needed to build more essential teams. It also determines the materiel and personnel surpluses.

Choke Point

A personnel skill or equipment item identified as critical by the Choke Analysis.

Commander's Decision Time

See Decision Time.

Critical Personnel Skill (Equipment Item)

A personnel skill (or equipment item) which would be needed to build another essential team. Critical skills and items are identified in the Choke Analysis.

Decision Time

Ref: Section 2.2.3

An AMORE program input.

Also called commander's decision time. A delay time imposed upon transfers between personnel skill groups and between equipment types which models the time it takes a commander to assess the condition of the unit and to decide how to reorganize.
NOTE: The delay time is not imposed upon transfers within a skill group or equipment type.

Degradation

Ref: Section 2.1.1.1

The simulated loss of unit resources.

Equipment Type

Ref: Section 2.2.2.3
2.3.2.1

An AMORE program input.

A category of unit materiel which contains all equivalent equipment items. (Items within the same equipment type are interchangeable.)

Essential Teams

Ref: Section 2.2.2.5
2.3.2.1

An AMORE program input.

The breakdown of the unit into components (teams) which contain only the personnel and materiel that are absolutely necessary to mission accomplishment.

Functional Analysis	A detailed study of a unit and mission to identify the functions, skills,and equipment needed to carry out the mission and to determine how the unit actually performs the functions.
Infinite Time Capability	See Maximum Capability.
Initial Capability	An AMORE program output.
Ref: Section 2.1.1.3	Also called zero time capability. The capability *immediately after* degradation, but before reconstitution of the unit begins.
Initial Strength	An AMORE program input.
Ref: Section 2.2.2.3 2.3.2.1	The pre-degradation inventories of personnel within each personnel skill group and materiel within each equipment type. Initial strengths are the units original supply.
Input Only	An AMORE program option.
Ref. Section 2.1.2.6 2.2.4.7 2.3.3.5	This option causes a listing of the input data to be printed, without any main program processing.
Iteration Ref: Section 2.1.1	A single replication of the AMORE model.
Light Damage	A damage level for equipment.
Ref: Section 2.2.2.3 2.2.3	Light damage can be repaired by the crew. Light damage requires an input PD and repair time for each equipment type.
Line Number Ref: Section 2.2.2.3	The index numbers for the personnel skill groups and the equipment types.
Maximum Capability	An AMORE program output.
Ref: Section 2.1.1.3 2.3.2.2	Also called Infinite Time Capability. Capability when all possible transfers and all possible equipment repairs have been made.

Mean Time Only

Ref: Section 2.1.2.5
2.2.4.6
2.3.3.4

An AMORE program option.

This option allows the user to designate how the input time values (transfer, decision, repair) are to be used. Deterministic - use the times as input. Exponential distribution - use the input times as the mean values of an exponential distribution and draw all time values from that distribution.

Minimum Capability

Ref: Section 2.1.1.3
2.3.2.2

An AMORE program output.

Capability evaluated immediately after the start of the reconstitution. All transfers are in progress, but only those with a total time (transfer + decision + repair) of zero have been completed.

Moderate Damage

Ref: Section 2.2.2.3
2.2.3

A damage level for equipment.

Moderate damage can be repaired by the unit, but not by the crew. Requires an input PD and repair time for each equipment type.

Multiple Optimal Solution (MOS)

Ref: Section 2.1.2.3
2.2.4.4
2.3.3.2

An AMORE program option.

This option provides choke analysis data for multiple optimal solutions. The model is generally exercised without this option and choke analysis data is for the first found optimal solution.

Number of Iteration

Ref: Section 2.1.2.1
2.2.4.2

An AMORE program feature.

This feature allows the user to specify the number of iterations for each AMORE run.

Personnel Skill Group

Ref: Section 2.2.2.3
2.3.2.1

An AMORE program input.

A category of unit personnel which contains all the people with common skills, capabilities, and vulnerabilities. (Personnel within the same skill group are interchangeable.)

Probability of Degradation (PD)

Ref: Section 2.2.3
2.3.2.1

An AMORE program input.

This set of input contains the probabilities of degradation for each

	personnel skill group and equipment type and the commander's decision times for each.
Reconstitution Ref: Section 2.1.1.2	The simulated reorganization of the unit into essential teams. The reorganization is designed to achieve the maximum teams in the minimum time.
Repair Time Ref: Section 2.2.2.3 2.3.2.1	An AMORE program input. The average time to repair light and/or moderate materiel damage is entered into the AMORE model for every equipment type.
Severe Damage Ref: Section 2.2.2.3	A damage level for equipment. Severe damage cannot be repaired by the unit. Items with severe damage are lost to the unit.
Team	An increment of capability. The absolute minimum people and equipment who can perform the functions of a team is called an Essential Team.
Times at Which to Evaluate Capability. Ref: Section 2.2.4.1	An AMORE program input. Also called Time Slices. The times specified by the user at which capability is evaluated.
Time Slices	See Times at Which to Evaluate Capability.
Transfer Matrix See Section 2.2.2.4 2.3.2.1	An AMORE program input. A matrix containing the average transfer times for either personnel of a skill group to substitute into other skill groups or equipment of a type to substitute into other equipment types.
Transfer Time	The elements of a transfer matrix. These times are the average times required for the substitution to become operational at an acceptable level of competence.

Transportation Algorithm	A standard network algorithm used to solve the transportation problem. A rudimentary knowledge of the problem and the algorithm is assumed throughout this manual.
Zero Time Capability	See Initial Capability.

CHAPTER 2

THE AMORE COMPUTER MODEL

2.1 INTRODUCTION AND GENERAL INFORMATION

This chapter presents the user with a non-programmer's understanding of the AMORE computer model. The chapter is divided into three sections. The first section contains an overview of the software, followed by a brief discussion of the model's output options. The second section describes the model input data and methods used to develop this data. Lastly, a section concerning model output is included.

2.1.1 AMORE Model Overview

The AMORE model structure is shown in Figure 2-1. The figure shows that the simulation loop is performed for every Probability of Degradation (PD) Set entered. Multiple PD Sets can be used to simulate different levels of degradation on the same unit.

The iteration loop is nested within the simulation loop. Because of the stochastic processes used in the methodology, a single iteration of the entire procedure is insufficient to insure statistically acceptable results. Typically, twenty-five or more iterations are necessary. Each iteration consists of applying damage to the unit and assessing the number of survivors, optimally reallocating the surviving resources to build the maximum number of teams, and finally calculating unit capability at various times following the damage.

BEGIN PROGRAM:

READ INPUT

PROCESSING PARAMETERS (OUTPUT OPTIONS, ETC.)
UNIT INVENTORY (NO. OF PEOPLE & AMOUNT OF EQUIPMENT, INCLUDING SPARES)
TEAM REQUIREMENTS (NO. OF PEOPLE & AMOUNT OF EQUIPMENT)
TIME PARAMETERS (TIMESLICES, TRANSFERS, REPAIRS)
RULES FOR SUBSTITUTING SKILLS & EQUIPMENT (TRANSFER MATRICES)

Simulation Loop

READ IN PROBABILITIES OF DEGRADATION (PDs) FOR THE INVENTORY AND ASSOCIATED TIMES TO INITIATE RECOVERY ACTIONS (DECISION TIMES)

BY ITERATION:

APPLY PERSONNEL DAMAGE RANDOMLY AND AGGREGATE SURVIVORS BY SKILL CATEGORY

Iteration Loop

BY MISSION:

Mission Loop - Personnel

- DETERMINE OPTIMAL (MINIMUM TIME) NO. OF TEAMS
- DETERMINE NO. OF TEAMS RECONSTITUTED AT SPECIFIED TIME SLICES
- CALCULATE RECORD OF PERSONNEL ASSIGNMENTS FOR TEAMS BUILT
- CALCULATE RECORD OF NEEDS & SURPLUSES FOR NEXT HIGHER NUMBER OF TEAMS (CHOKE ANALYSIS)
- GO TO NEXT MISSION

AT END: BEGIN MATERIEL LOOP

APPLY MATERIEL DAMAGE RANDOMLY & AGGREGATE SURVIVORS BY MATREIEL CATEGORY FOR NO, LIGHT, & MODERATE DAMAGE

BY MISSION:

Mission Loop - Materiel

- DETERMINE MAXIMUM NO. OF TEAMS IN THE MINIMUM AMOUNT OF TIME
- DETERMINE NO. OF TEAMS RECONSTITUTED AT SPECIFIED TIME SLICES
- CALCULATE RECORD OF MATERIEL ASSIGNMENTS FOR TEAMS BUILT
- CALCULATE RECORD OF NEEDS & SURPLUSES FOR NEXT HIGHER NUMBER OF TEAMS (CHOKE ANALYSIS)
- GO TO NEXT MISSION

AT END: CALCULATE STATISTICS FOR THIS ITERATION
GO TO NEXT ITERATION

AT END:
- AFTER LAST ITERATION CALCULATE EXPECTED VALUES & ASSOCIATED CONFIDENCE UNITS
- PRINT OUT RESULTS OF METHODOLOGY AVERAGED OVER ALL ITERATIONS TO OUTPUT
- GO TO NEXT SET OF PDs

AT END: - AFTER LAST SET OF PDs, END PROGRAM

Figure 2-1. Iterative Structure of Program AMORE Processing Flow

These processes, within the iteration loop, are repeated for each mission defined by the user. This provides a means for examining and comparing, in a single execution of the model, a unit's capability to accomplish different missions following any particular degradation of its assets. These processes are performed first for personnel and then for the materiel items of the unit.

The iteration loop is repeated until a preselected number has been reached. (Use the Number of Iterations Option to select this number.) When all iterations have been completed, the capability results for each mission considered is printed. The model will repeat the simulation loop until all PD Sets have been considered.

Each iteration can be divided into three parts: the degradation, the reconstitution, and the capability calculations. A discussion of these parts follows.

2.1.1.1 The Degradation

The AMORE model simulates personnel degradation by dividing the unit into two groups: survivors and casualties. This terminology is used because organizations are often degradated by simulated attacks. This division is done by using the probabilities of degradation (PD) which were input for each personnel skill group. A uniformly distributed random number between 0 and 1.0 is generated for each individual and compared to the PD for that person's skill group. If this random number is greater than the PD, the person survives; if not, the person is declared a casualty and is considered unavailable to the unit.

Equipment degradation is conducted analogously, except that materiel items are divided into four categories: survivors, lightly damaged, moderately damaged, and severely damaged. Each equipment

type has three PDs corresponding to the three levels of damage: light, moderate, and severe. The random number generated, when compared to the three PDs, determines which category of damage is assessed against an item. Items assessed as having light or moderate damage are made available after a delay which depends upon the unit's capability to perform necessary repairs. Items suffering severe damage are lost by the unit.

2.1.1.2 The Reconstitution

After degradation, the model establishes the maximum number of teams that can be rebuilt by the surviving personnel and materiel for each mission. It accomplishes this by using a binary search technique coupled with a transportation algorithm. The degradation defines the supply (the survivors) and the binary search is used to define the demand (the numbers of teams). The transportation algorithm determines if it is possible to reorganize the unit into the number of teams picked by the binary search, and if so, minimizes the times to reconstitute the unit (subject to supply and demand constraints). The search stops when it is possible to reorganize the degraded unit into a number of teams, but no more than that number. This number is the maximum number of teams which can be rebuilt by the unit.

2.1.1.3 The Capability Calculations

At the end of each iteration of the AMORE run, data is accumulated for statistics. These data will be used to calculate capability. Capability at a given time is the number of teams that the unit can build at that time, divided by the total number of teams. Capability is calculated at user selected times and at three additional times. Capability at these three extra times are called:

- Initial capability
- Minimum capability
- Maximum capability

Initial capability (sometimes called zero time capability) is the percent of total teams still intact immediately after degradation. This is unit capability before any reconstitution has occurred. Minimum capability is the percent of total teams obtained when the reconstitution begins. All transfers have started, but only those with zero transfer times have been completed. The maximum capability (sometimes called infinite time capability) is the capability obtained when all substitutions have been made. The maximum capability will show any late gain in capability.

All of these capabilities are calculated separately for materiel and personnel. The unit capability is the minimum of these two capabilities. These calculations are repeated for each mission under consideration. After all iterations are complete, these capability calculations will be printed as part of the standard model output. (See Section 2.3.2.) Optional AMORE features are discussed in the following section.

2.1.2 Available Options

2.1.2.1 Number of Iterations

The number of iterations for an AMORE run may be specified by the user.

2.1.2.2 Choke Analysis

A choke analysis determines what assets are necessary to complete the next higher team. This is done by adding enough dummy supply assets to allow completion of that team. These dummy assets are given a very large transfer time and the transportation algorithm is again applied. The assignments of dummy assets identify the things (personnel or materiel) which are critical to the completion of that team because the large transfer times keep the assets from being used unless absolutely necessary.

The choke analysis reveals surplus skills and equipment items as well as those which are critical. Note that by analyzing different missions, choke analyses can be used to examine the strengths and/or weaknesses of an organization's TOE. This option can be selected with the Choke Analysis Flag. (See Section 2.2.4.3)

2.1.2.3 Multiple Optimal Solutions (MOS)

NOTE: This option can only be used when a choke analysis has been performed.

The analysis of the choke data may be expanded by examining multiple optimal solutions. Although the first solution found is an optimal solution in terms of minimizing time cost, there may be other solutions, still optimal, which require cheaper assets in terms of dollar costs, training costs, or general availability. This option allows the search for a specified number of alternate solutions or for all possible optimal solutions. Alternate solutions are sought only for those items which are critical to the building of the choke team. All alternate solutions for an iteration are averaged and the average solution for each iteration is stored. All iterations which choke on

this team are then averaged for output. The limits of the distribution are also output, i.e. the minimum and maximum value for each choke point over all solutions found. The MOS option can be selected with the MOS flag (Section 2.2.4.4).

2.1.2.4 Assignment Matrices

When the assignment matrix option is used, the model records how the personnel and materiel resources are allocated when building the maximum number of teams. Since the model may not be able to build the same number of teams in every iteration, these assignments are accumulated separately for iterations with a common maximum number of teams. The elements of the matrices are the average assignments. The number of iterations and maximum number of teams which correspond to the assignments are noted on the matrix. This option can be selected with the assignment matrix flag (Section 2.2.4.5).

2.1.2.5 Mean Time Only

Typically, the transfer times for materiel and personnel and the repair times for materiel are treated as the means of exponentially distributed random variables. The times actually used during the simulation are sampled from the distributions defined by the mean times. The exponential distribution is used here since it is a frequently observed waiting time distribution. If this sampling procedure is not desired, the mean time only option can be used to by-pass it. This option can be selected with the mean time only flag (Section 2.2.4.6).

2.1.2.6 Input Only

A printout of the input data can be obtained by using the input only option. It is strongly recommended that the user verify the input data before running the complete simulation. This option can be selected with the input only flag (Section 2.2.4.7).

2.2 AMORE MODEL INPUT

2.2.1 Introduction

This section discusses both the AMORE model input and the analysis which is needed to develop the model input. Input to the model is listed in Figure 2-2. This list is not complete; variables such as those which set the dimensions of arrays in the model are not included. The discussion here is directed at the organizational analyst rather than the computer scientist. For technical information (card formats, FORTRAN variable names, etc.), refer to Chapter 3.

Throughout this section, the following sample problem will be used to illustrate the discussion.

The U.S. Army is modifying the table of organization and equipment (TOE) for a mechanized infantry company so that the unit will carry out its missions more effectively. A unit proposed TOE is to be examined.

Using the AMORE methodology, examine the mechanized infantry company in the mounted "attack" role. The mission is defined as a basic combat requirement which also requires maintenance and command and control (C^2). The unit's ability to reconstitute itself following enemy inflicted attrition is to be assessed during the six hour period after attack. Key personnel and materiel items which impact on the unit's capability are to be identified.

INPUT	REFERENCE SECTION
INPUT DETERMINED BY FUNCTIONAL ANALYSIS.	2.2.2
1. Unit Missions.	2.2.2 2
2. Initial Strengths.	2.2.2.3
1. Personnel	
1. Name of each Personnel Skill Group	
2. Number of Personnel within each Skill Group	
2. Materiel	
1. Name of each Equipment Type	
2. Number of items in each Equipment Type	
3. Time (in minutes) to repair light damage	
4. Time (in minutes) to repair moderate damage	
3. Transfer Matrices	2.2.2.4
1. Personnel Transfer Matrix	
2. Materiel Transfer Matrix	
4. Requirements for Essential Teams.	2.2.2.5
1. Requirements for Personnel Teams	
2. Requirements for Materiel Teams	
PROBABILTIY OF DEGRADATION (PD) SET INPUT	2.2.3
1. Title of PD Set	
2. Personnel	
1. Probabilities of Degradation	
2. Commander's Decision Time (in minutes)	
3. Materiel	
1. Probability of Light Damage	
2. Probability of Moderate Damage	
3. Probability of Severe Damage	
4. Commander's Decision Time (in minutes)	
OTHER INPUT	2.2.4
1. Times at which to evaluate capability	2.2.4.1
2. Number of Iterations.	2.2.4.2
3. Choke Analysis Flag	2.2.4.3
4. Multiple Optimal Solution (MOS) Flag.	2.2.4.4
5. Assignment Matrices Flag.	2.2.4.5
6. Mean Time Only Flag	2.2.4.6
7. Input Only Flag	2.2.4.7

Figure 2-2. AMORE Model Input

2.2.2 Input Related to Functional Analysis

2.2.2.1 Introduction

The functions of the organization and how the functions interrelate must be determined. These functions are actions which must be performed to accomplish the mission. As an example, the attack mission demands the functions: target detection, target identification, target assignment, target engagement, target surveillance and, if necessary, reengagement. There are sub-functions such as movement in order to engage or, in some cases, survival to reengage.

These functions are related to the unit by using a functional analysis. Once the functions required by the mission are identified, the functional analysis is used to address more pointed questions. These questions include the following:

Who performs which function?
What equipment is needed for each function?
In what order are functions performed?
How long does each take?
How many people and how much materiel is needed?

2.2.2.2 Unit missions

The unit mission is not input in the literal sense, but it is of primary importance to the analysis because the mission determines the requirements for essential teams. (See Section 2.2.2.5). A mission which requires most of the skills groups and equipment types will generally provide the most information, because it forces the unit to draw upon its resources. Unit missions should also make simultaneous demands on multiple functions within the organization. Do not forget

the day-to-day routine demands on a unit which occur at the same as the high priority demand of a special nature.

Analyses of more than one mission may be required in order to understand an organization's ability to function under pressure.

2.2.2.3 Initial strengths

The initial strengths are the predegradation inventories of the individuals within the personnel skill groups and the items within the equipment types. These initial strengths specify the total supply available in each category. The usual source of information for this input is the unit TOE. Note that by changing the initial strengths, changes in the unit TOE can be assessed by the AMORE methodology.

The user may name each personnel skill group and equipment type as well as specifying the number of people or things within the categories. The personnel skill groups and equipment types are numbered in the order in which they are entered into the computer. These numbers are the personnel and equipment line numbers, which serve to index these categories. Output from the model is labelled with the entered names and numbered with the line numbers.

Further input is required for materiel. Recall that equipment damage is sorted into damage that can be repaired by the crew (light damage), damage that requires higher level repair but can be repaired within the unit (moderate damage), damage that must be evacuated for repair or is unrepairable, and finally undamaged equipment (no repair required). The repair times for light and moderate damage are included in order to realistically model materiel reconstitution. These times are usually a result of research, surveys, and an examination of maintenance records.

EXAMPLE: Initial Strength

In the mechanized infantry company example, capability of the unit with a proposed TOE is to be assessed. Therefore, the initial strengths are defined directly from the TOE and listed in Figures 2-3 and 2-4. Note that the line numbers are included in the figures.

The damage repair times for materiel are listed in Figure 2-5. Assume (for example purposes) that they represent the average repair times for each equipment type, according to maintenance records.

2.2.2.4 Transfer Matrix

For a unit commander in combat the balancing of resources against mission requirements is essentially a supply and demand problem. Commanders are always reconstituting their units, even in peacetime. They consider the assets on hand and the demands of the mission(s) at hand. The exercise of command becomes a continuous reallocation of resources to meet the mission and functional demands. In AMORE, the representations of allocation potential are the transfer matrices.

A transfer matrix indicates how long each personnel or materiel substitution takes to complete. Each transfer matrix has row and column headings which correspond to the personnel or materiel line numbers. Personnel or equipment defined by the rows will substitute for those defined by the columns. Matrix entries represent the average time (minutes) for the substitution to be operational with an acceptable degree of capability. Zeros occur when the substitution is operational immediately. The diagonal elements (same row and column number) are all zero since the diagonal elements represent the time it takes for a personnel skill or equipment type to fill in for

LINE	PERSONNEL SKILL GROUPS	INITIAL STRENGTHS
1	CO	1
2	XO	1
3	1 SGT	1
4	SUPPLY SGT	1
5	TAC COMM CHIEF	1
6	ARMORER	1
7	CARRIER DRIVER	20
8	RTO	6
9	SUPPLYMAN	1
10	MOTOR SGT	1
11	SR RECOVERY VEH OP	1
12	SR TRACK VEH MECH	1
13	EQUIPMENT MAINT CLK	1
14	TAC COMM SYS OP/MECH	1
15	RECOVERY VEH OP	1
16	TRACK VEH MECH	5
17	RIFLE PLT LDR	3
18	RIFLE PLT SGT	3
19	ASST PLT SGT	3
20	SQUAD LDR	9
21	TEAM LDR	18
22	AUTO RIFLEMAN	18
23	GRENADIER	18
24	RIFLEMAN	27
25	WPN PLT LDR	1
26	WPN PLT SGT	1
27	MORTAR SEC LDR	1
28	FIRE DIR CMPT	2
29	MORTAR SQD LDR	3
30	MORT GUNNER/ASST GUNNER	6
31	AMMO BEARER	3
32	ANTITANK SEC LDR	1
33	ANTITANK SQD LDR	1
34	TOW GUNNER	2
35	ASST TOW GUNNER	2
	TOTAL	166

FIGURE 2-3 Personnel Initial Strengths Mech Infantry Company

LINE	EQUIPMENT TYPE	INITIAL STRENGTH
1	CO CARRIER (KY38, GRA-39, VRC-46, VRC-47, PRC-77)	1
2	XO CARRIER (KY38, GRA-39, VRC-46, PRC-77)	1
3	TRUCK 1/4 T (Y38, GRA-39,VRC-46, PRC-77)	1
4	TRAILER 1/4 T	1
5	TRUCK 2 1/2 T SUPPLY	1
6	TRAILER 1 1/2 T SUPPLY	1
7	RECOVERY VEHICLE (VRC-46)	1
8	TRUCK 2 1/2 T MAINT	2
9	TRAILER 1 1/2 T MAINT	1
10	PLT LDR CARRIER (PRR-9, GRC-160)	3
11	RFL SQD LDR CARRIER (PRR-9, GRC-160)	9
12	TRUCK 1/4 T PLT HQs (GRC-160, VRC-46)	2
13	TRAILER 1/4 T PLT HQs	2
14	MORTAR SEC HQs CARRIER (GRC-160)	1
15	MORTAR CARRIER (GRC-160)	3
16	TOW CARRIER (GRC-160)	2
17	MG 7.62	15
18	DRAGON ANTITANK WPN	9
19	RIFLE 5.56	153

Parenthesis indicate radios associated with vehicles

FIGURE 2-4 Materiel Initial Strengths Mech Infantry Company

LINE	EQUIPMENT TYPE	DAMAGE REPAIR TIMES LIGHT	MODERATE
1	CO CARRIER	60	240
2	XO CARRIER	60	240
3	TRUCK ¼ T	45	180
4	TRAILER ¼ T	15	90
5	TRUGK 2½ T SUPPLY	45	180
6	TRAILER 1½ T SUPPLY	15	90
7	RECOVERY VEH	60	240
8	TRUCK 2½ T MAINT	45	180
9	TRAILER 1½ T-MAINT	15	90
10	PLT LDR CARRIER	60	240
11	SQD LDR CARRIER	60	240
12	TRUCK ¼ T PLT HQ	45	180
13	TRAILER ¼ T PLT HQ	15	90
14	MORTAR SEC HQ CARRIER	60	240
15	MORTAR CARRIER	60	240
16	TOW CARRIER	60	240
17	MG 7.62	30	180
18	DRAGON ANTI TANK	30	180
19	RIFLE 5.56	15	60

FIGURE 2-5. TIMES (MINUTES) TO REPAIR LIGHT AND MODERATELY DAMAGED EQUIPMENT.

itself. A number other than zero in the matrix represents the time in minutes for that substitution to reach an acceptable level of capability in performance. When a particular transfer is not allowed (usually because the time involved is too long), a negative number is entered into the model. Infeasible transfers are indicated by a "." instead of a number in the transfer matrix print-outs.

Developing a personnel transfer matrix requires one of two decisions per row/column cell. Can an individual with the row skill substitute for someone with the column skill? If so, how long does it take on the average for the substituted skill to attain acceptable operational capability? The elements of the transfer matrix are estimates of the time needed to move to a different location and/or become reasonably proficient at a different skill. The decisions made when developing this matrix are usually based upon common sense and experience.

The materiel transfer matrix is developed similarly to the personnel transfer matrix. Each entry in the matrix requires one or two decisions. Can the row item substitute for the column item? If so, is there a transfer time required to make the item ready for its new function within unit resources? For example, the executive officer's carrier can become the company command carrier (assuming colocation) at no cost in time. A TOW carrier can become the command carrier, but time is required to change radios to provide the proper netting capability for the substituted carrier. Decisions made about the materiel transfer matrix tend to be more straightforward than the analogous decisions for personnel.

EXAMPLE: Transfer Matrices

Figures 2-6 and 2-7 are the transfer matrices for the mechanized infantry company. The number heading the rows and columns of

TRANSFER MATRIX FOR PERSONNEL

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	0	0	0	30	.	.	0	0	0	.	30	.	30	.	10	.	0	0	0	0	0	0	0	0	0	0	0	15	0	15	0	0	0	10	0
2	0	0	0	30	.	.	0	0	0	.	30	.	30	.	10	.	0	0	0	0	0	0	0	0	0	0	0	15	0	15	0	0	0	10	0
3	15	0	0	30	.	.	0	0	0	10	30	.	30	.	10	.	0	0	0	0	0	0	0	0	30	15	15	15	0	15	0	0	0	10	0
4	.	.	60	0	.	0	.	0	0	.	.	.	10	.	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	10	20	5
5	.	.	60	30	0	.	.	0	0	.	.	.	10	0	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	10	20	5
6	.	.	.	30	.	0	.	10	0	.	.	.	10	.	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	30	5
7	.	.	.	.	.	.	0	0	10	.	30	.	.	.	10	30	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
8	.	.	.	.	.	.	.	0	10	.	.	.	.	30	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
9	.	.	.	60	.	30	.	10	0	.	.	.	10	.	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
10	.	.	60	30	.	30	0	0	0	0	0	0	0	.	0	0	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	10	20	5
11	.	.	.	.	.	.	0	0	0	30	0	30	10	.	0	0	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
12	.	.	.	.	.	30	0	0	0	30	10	0	10	.	0	0	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
13	.	.	.	60	.	.	.	10	0	.	.	.	0	.	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
14	.	.	.	.	30	.	.	0	10	.	.	.	30	0	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
15	.	.	.	.	.	.	0	0	10	60	10	60	30	.	0	.	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
16	.	.	.	.	.	60	0	10	10	.	30	30	30	.	10	0	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
17	30	15	15	30	.	.	0	0	0	.	30	.	30	.	10	.	0	0	0	0	0	0	0	0	10	0	0	15	0	15	0	0	0	10	0
18	60	30	30	.	.	.	0	0	0	.	30	.	30	.	10	.	0	0	0	0	0	0	0	0	30	15	15	30	0	15	0	0	0	10	0
19	.	.	.	.	.	.	0	0	0	.	30	.	30	.	10	.	30	10	0	0	0	0	0	0	60	30	30	.	0	15	0	0	10	30	0
20	.	.	.	.	.	.	0	0	0	.	.	.	.	.	.	.	.	30	10	0	0	0	0	0	.	.	.	.	.	.	0	30	10	30	5
21	.	.	.	.	.	.	0	0	0	.	.	.	.	.	.	.	.	60	30	10	0	0	0	0	.	.	.	.	.	.	0	.	.	.	5
22	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	10	0	0	0	.	.	.	.	.	.	0	.	.	.	5
23	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	10	0	0	0	.	.	.	.	.	.	0	.	.	.	5
24	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	30	0	0	0	.	.	.	.	.	.	0	.	.	.	5
25	30	15	15	30	.	.	0	0	0	10	30	.	30	.	10	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
26	60	30	30	.	.	.	0	0	0	.	30	.	30	.	10	.	15	10	0	0	0	15	15	0	0	0	0	0	0	0	0	0	0	10	0
27	.	.	.	.	.	.	0	0	0	.	30	.	30	.	10	.	.	30	10	30	10	15	15	0	30	10	0	0	0	0	0	10	0	10	5
28	.	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	30	0	0	10	10	0	.	.	.	5
29	.	.	.	.	.	.	0	0	0	.	.	.	.	.	.	.	.	.	.	.	30	15	15	0	.	.	10	10	0	0	0	15	10	15	5
30	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	.	30	30	10	0	0	30	.	.	5
31	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	10	0	.	.	.	5
32	.	.	.	.	.	.	0	0	0	.	30	.	30	.	10	.	.	30	10	30	10	15	15	0	30	10	10	10	10	10	0	0	0	0	0
33	.	.	.	.	.	.	0	0	0	.	.	.	.	.	.	.	.	.	.	.	30	15	15	0	.	30	30	30	30	15	0	10	0	0	0
34	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	30	0	10	0	0	0
35	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	10	0	0

Figure 2-6. Personnel Transfer Matrix

TRANSFER MATRIX FOR MATERIAL

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	0	0	.	30	.	.	30	.	0	0	0	.	0	30	.	.	.	.
2	0	0	0	.	30	.	.	30	.	0	0	0	.	0	30	.	.	.	.
3	.	.	0	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.
4	.	.	.	0	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.
5	.	.	30	.	0	.	.	10	.	.	.	30	.	.	.	.	.	.	.
6	.	.	.	.	.	0	.	.	0	.	.	.	.	.	.	.	.	.	.
7	.	.	10	.	.	.	0	.	.	.	.	10	.	.	.	.	.	.	.
8	.	.	30	.	10	.	.	0	.	.	.	30	.	.	.	.	.	.	.
9	.	.	.	.	.	0	.	.	0	.	.	.	.	.	.	.	.	.	.
10	10	10	0	.	30	.	.	30	.	0	0	0	.	0	30	.	.	.	.
11	10	10	0	.	30	.	.	30	.	0	0	0	.	0	30	.	.	.	.
12	.	.	10	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.
13	.	.	.	0	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.
14	30	30	0	.	30	.	.	30	.	10	0	0	.	0	30	.	.	.	.
15	30	30	0	.	30	.	.	30	.	30	30	0	.	0	0	.	.	.	.
16	30	30	0	.	.	.	.	.	.	.	.	0	.	0	.	0	.	.	.
17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.
18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.
19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0

Figure 2-7. Materiel Transfer Matrix.

the matrices (1 through 35 for personnel, 1-19 for materiel) relate to the personnel and materiel line numbers which were assigned when the initial strengths were set up. (See Section 2.2.2.3) Each cell of both matrices represents judgements about substitutability made by the analyst. The analyst draws upon all knowledge of the organization, personnel skill groups, and equipment types in order to make these decisions.

2.2.2.5 Requirements for essential teams

It is here that the user must specify how the mission is to be performed. The user must answer such questions as: what are the increments of capability? Should the first increment (team) include the company commander on a platoon leader? Where should maintenance be included?

A helpful question, at this point: if only one increment of capability could be built, what should it contain? Next, if only two increments of capability could be built, what should they contain? The second increment of capability will be the difference between the above two answers. This process is continued until all required functions are accounted for.

This step requires merging personnel and materiel to form essential teams. The user should remember that resources are limited. The addition of materiel may generate the need for more skills (to maintain, to hook-up, etc.). Therefore, the personnel skills and materiel items assigned to a team must be essential to the team. In other words, it must be true that the team could not perform its function without all of its assigned personnel skills and materiel items. Caution should be taken not to assign personnel skills and materiel items without which the function can still be performed. Where the issue

is in doubt, the AMORE methodology can be used to ascertain the difference in unit capability obtained by adding the desired skill or item. It can then be determined if the addition is justified. A personnel skill or equipment item should not be required by a team unless it is needed to perform the teams function.

Teams do not have to be either linear or homogeneous. For most analyses, however, it is prudent to develop equal slices of capability and have each team represent that equal slice. In any case, the final building of the teams is reserved for the last step to accommodate the insights previously developed during the building of the transfer matrices. It may take a few attempts to determine the requirements for essential teams.

EXAMPLE: Requirements for Essential Teams

By conducting a thorough analysis of the unit TOE and the mission it is expected to accomplish, three basic functions (attack, C^2 and maintenance) are to be performed by the unit. The first is the attacking of the enemy position by the infantry teams mounted in carriers. Included in this are mounted supporting weapon systems. The second is the command and control of these teams by company and platoon headquarters. The last is providing maintenance support to all elements involved in the attack. The latter two functions are also to be performed using vehicles with the same mobility characteristics as those used by the infantry teams.

Any one of a number of ways may be used to determine the skill requirements for the essential teams needed to perform the three basic functions. For the sake of clarity, the method of pyramiding command control requirements is used. Assume this begins with eighteen minimum infantry fire teams establishing the basis for each team within the company. Each fire team has a team leader, an automatic

rifleman, a grenadier and a rifleman. This initial assignment is as shown in Figure 2-8.

LINE	SKILL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOT	UN-USED
		REQUIREMENTS FOR ESSENTIAL TEAMS																			
21	TEAM LDR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
22	AUTO RIFLE-MAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
23	GRENADIER	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
24	RIFLEMAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	9

Figure 2-8. Example of Essential Team Build

For direct command and control of these teams, a squad leader is assigned to supervise each pair. Projecting these control personnel onto the previous array, the results are as depicted in Figure 2-9. For this problem solution, it is determined that three fire teams require the supervision of a platoon leader (the next higher echelon of command contol). So, the platoon leaders are assigned to the third fire team within their respective platoons. Since each complete platoon consists of three complete squads, this assignment results in the information matrix in Figure 2-10.

The company commander, the final command and control, is assigned at the point where the first platoon is complete and the second platoon has only one fire team. By adding the company commander to this team position (Team 7), the requirement matrix becomes that which is shown in Figure 2-11.

LINE	SKILL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOT	UN-USED
		REQUIREMENTS FOR ESSENTIAL TEAMS																			
20	SQUAD LDR		1		1		1		1		1		1		1		1		1	9	0
21	TEAM LDR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
22	AUTO RIFLE-MAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
23	GRENADIER	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
24	RIFLEMAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	9

Figure 2-9. Example of Essential Team Build.

LINE	SKILL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOT	UN-USED
		REQUIREMENTS FOR ESSENTIAL TEAMS																			
17	RIFLE PLT LDR			1						1						1				3	0
20	SQUAD LDR		1		1		1		1		1		1		1		1		1	9	0
21	TEAM LDR	1	1	1	1	[illegible]	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
22	AUTO RIFLE-MAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
23	GRENADIER	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
24	RIFLEMAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	9

Figure 2-10. Example of Essential Team Build.

LINE	SKILL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOT	UN-USED
		REQUIREMENTS FOR ESSENTIAL TEAMS																			
1	COMPANY COMMANDER							1												1	0
17	RIFLE PLT LDR			1						1						1				3	0
20	SQUAD LDR		1		1		1		1		1		1		1		1		1	9	0
21	TEAM LDR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
22	AUTO RIFLE-MAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
23	GRENADIER	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
24	RIFLEMAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	9

Figure 2-11. Example of Essential Team Build

At this point the basic infantry teams along with appropriate levels of command and control have been established. To complete the matrix only the assignments of maintenance personnel, drivers, mortar squads and anti-tank crews remain. Note that nine riflemen are not required by essential teams. They will be candidates for replacements during reconstitution. Before continuing with personnel assignments, however, a description of the building of corresponding essential materiel teams is in order.

A carrier and DRAGON are assigned to each team containing a squad leader. Additionally a carrier is assigned to each team containing a platoon leader and the one containing the company commander. Finally, each carrier assigned thus far is assigned a machine gun. This then makes the initial essential equipment teams appear as depicted in Figure 2-12.

LINE	ITEM	REQUIREMENTS FOR ESSENTIAL TEAMS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOT	UN-USED
1	CO CARRIER							1												1	0
10	PLT LDR CARRIER			1						1						1				3	0
11	SQD LDR CARRIER		1		1		1		1		1		1		1		1		1	9	0
17	MG 7.62		1	1	1		1	1	1	1	1		1		1	1	1		1	13	2
18	DRAGON		1		1		1		1		1		1		1		1		1	9	0

Figure 2-12. Example of Essential Team Build.

From here on, logic, common sense and experience play important roles in the assignment of the remaining portion of the company's resources allotted to the attack mission. From a mobility standpoint there is a distinct advantage in assigning a carrier to each team. However, an examination of the initial materiel teams reveals that teams 1, 5, 11, 13 and 17 remain without transport. For this solution, the position is taken that this is to be afforded by assignment of the supporting weapons' carriers (TOWs and mortars).

The lowest level at which the TOW would be expected to be deployed and controlled is assumed to be at the squad level. This is accomplished by moving the squad leader carrier in team 2 to team 1 and assigning the first TOW carrier to team 2. The second TOW carrier is assigned to team 11 to lend balance with the mortar carriers assigned to the remaining teams lacking transport (teams 5, 13 and 17). Returning to the personnel teams, the crews associated with these supporting weapons are now assigned. Additionally a carrier driver is assigned to each of the eighteen teams as each now contains a carrier. Next, the maintenance personnel are assigned to team 7 for the purpose of being under centralized control of the company commander.

The recovery vehicle being associated with maintenance personnel is now added to team 7 of the materiel teams. Finally the rifles are assigned to personnel in each team that are authorized to carry that weapon. For example, all personnel except the company commander and the recovery vehicle operator carry rifles. Their weapons are considered insignificant in this problem solution and are not entered into the materiel teams.

The assignment of essential personnel and equipment into teams is now complete as depicted by the requirements shown in Figure 2-13 and 2-14.

The method just used to build the essential personnel and materiel teams is only one of many. It may be noted that some assignments of resources were linear (infantry fire teams) while others were made for reasons which satisfied a particular logic. There is no reason why this or any other organization could not have teams built to suit the purposes of the user. Different analysts may develop different essential teams, yet each team build could be analytically valid.

2.2.3 Probability of Degradation (PD) Set Input

Each probability of degradation (PD) set contains the degradation probabilities for personnel and materiel, as well as the commander's decision times (in minutes) for personnel and materiel reconstitution. The user may also input a name for the PD set, if desired for output titling.

PD sets for personnel and materiel enable the user to tailor the simulated degradation to the military unit and the analysis. Degradation is assessed stochastically by the AMORE model; the greater

LINE	SKILL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOT	UN-USED
		REQUIREMENTS FOR ESSENTIAL TEAMS																			
1	COMPANY COMMANDER							1												1	0
7	CARRIER DRIVER	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	2
10	MOTOR SGT							1												1	0
15	RECOVERY VEH OP							1												1	0
16	TRACK VEH MECH							2												2	3
17	RIFLE PLT LDR			1						1						1				3	0
20	SQUAD LDR		1		1		1		1		1		1		1		1		1	9	0
21	TEAM LDR	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
22	AUTO RIFLE-MAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
23	GRENADIER	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	0
24	RIFLEMAN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18	9
29	MORTAR SQD LDR					1								1				1		3	0
30	MORTAR GUNNER					2								2				2		6	0
32	ANTI TANK SEC LDR		1																	1	0
33	ANTI TANK SQD LDR											1								1	0
34	TOW GUNNER		1									1								2	0

Figure 2-13. Requirements for Essential Personnel Teams

LINE	ITEM	REQUIREMENTS FOR ESSENTIAL TEAMS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOT	UN-USED
1	CO CARRIER							1												1	0
7	RECOVERY VEH							1												1	0
10	PLT LDR CARRIER			1						1						1				3	0
11	SQD LDR CAR-RIER	1			1		1		1		1		1		1		1		1	9	0
15	MORTAR CAR-RIER					1								1				1		3	0
16	TOW CARRIER		1									1								2	0
17	MG 7.62		1	1	1		1	1	1	1	1		1		1	1	1		1	13	2
18	DRAGON		1		1		1		1		1		1		1		1		1	9	0
19	RIFLE 5.56	5	8	6	6	8	6	8	6	6	6	7	6	8	6	6	6	8	6	118	35

Figure 2-14. Requirements for Essential Materiel Teams.

the PD, the more likely that the personnel skill group or materiel type will be degradated. Degradation probabilities are input to the model based on an analysis of the particular degrading mechanism (i.e., nuclear, conventional, or chemical weapons, drug abuse, assignment policy, etc.) and the vulnerability of the unit assets.

When the degrading mechanism is an enemy weapon, the PD's can usually be derived using Joint Munitions Effectiveness Manual (JMEM) methodologies. These methodologies are universally accepted and can be used to develop PD sets which reflect the posture of the organization and the attacking munition.

Materiel probabilities of degradation, which are developed concurrently with the personnel PDs, are input in a different format since three analytically determined PDs (user inputs) for a given materiel category for light damage, moderate damage, and severe damage are required. These values must be input cumulatively, in descending order, to satisfy the degradation algorithm. To determine these, consider the set of PD values shown in Figure 2-15. In the left frame, four sets of values are shown noncumulatively, as determined analytically with respect to the particular AMORE application. The right frame shows them in the cumulative form as required for data entry to run the AMORE program. The column labeled 'AT LEAST LIGHT' contains the sum of the light, moderate, and severe damage probabilities and the column labeled 'AT LEAST MODERATE' contains the sum of the PDs for moderate and severe damage.

Examples of Noncumulative PDs				The Cumulative PDs for Input		
NO DAMAGE	LIGHT	MODERATE	SEVERE	AT LEAST LIGHT	AT LEAST MODERATE	SEVERE
.86	.05	.06	.03	.14	.09	.03
.89	.05	.06	.00	.11	.06	.00
.95	.05	.00	.00	.05	.00	.00

Fiqure 2-15. Examnle of Materiel PD Set

The commander's decision times are used to simulate the time needed for the commander to assess the condition of the unit and decide how to reorganize. The decision times are added to all of the non-diagonal numeric elements of the personnel and materiel transfer matrices. (Recall that the numeric elements denote possible substitutions; decision times are not added to diagonal elements because people and equipment within the same personnel skill group or equipment type are assumed to perform their own job without command to do so.)

NOTE: The minimum capability (See Section 2.1.1.3) measures the capability of the unit at a time when other transfers are in progress and only these automatic job fills are operational.

EXAMPLE: PD Sets

Figure 2-16 contains the personnel PDs and Figure 2-17 contains the cumulative materiel PDs for the mechanized infantry company example. Assume that these probabilities were derived using JMEM methodologies. These methodologies require some knowledge of the attacking munition and organization posture. For instance, by assuming that the mechanized infantry company in a mounted attack role was being attacked by an enemy aircraft loaded with a known type of guided missiles, the analyst could use JMEM methodologies to determine degradation probabilities.

LINE	SKILL	DEGRADATION PROBABILITY
1	COMPANY COMMANDER	.15
2	EXECUTIVE OFFICER	.13
3	FIRST SERGEANT	.13
4	SUPPLY SERGEANT	.13
5	TAC COMM CHIEF	.13
6	ARMORER	.13
7	CARRIER DRIVER	.18
8	RTO	.13
9	SUPPLYMAN	.13
10	MOTOR SERGEANT	.15
11	SR RECOVERY VEH OP	.13
12	SR TRACK VEH MECH	.13
13	EQUIP MAINT CLERK	.13
14	TAC COMM SYS OP/MECH	.13
15	RECOVERY VEH OP	.15
16	TRACK VEH MECH	.15
17	RIFLE PLT LDR	.18
18	RIFLE PLT SGT	.13
19	ASST PLT SGT	.13
20	SQUAD LDR	.18
21	TEAM LDR	.18
22	AUTO RIFLEMAN	.18
23	GRENADIER	.18
24	RIFLEMAN	.18
25	WPN PLT LDR	.13
26	WPN PLT SGT	.13
27	MORTAR SEC LDR	.14
28	FIRE DIR CMPT	.13
29	MORTAR SQD LDR	.14
30	MORTAR GUNNER	.14
31	AMMO BEARER	13
32	ANTI TANK SEC LDR	.18
33	ANTI TANK SQD LDR	.18
34	TOW GUNNER	.18
35	ASST TOW GUNNER	.18

Figure 2-16. Probability of Personnel Degradation

LINE	ITEM	CUMULATIVE DAMAGE PROBABILITIES AT LEAST LIGHT (TOTAL)	AT LEAST MODERATE (MOD & SEV)	SEVERE
1	CO CARRIER	.300	.220	.080
2	XO CARRIER	.270	.190	.060
3	TRUCK ¼ T	.270	.190	.060
4	TRAILER ¼ T	.270	.190	.060
5	TRUCK 2½ T SUPPLY	.270	.190	.060
6	TRAILER 1½ T SUPPLY	.270	.190	.060
7	RECOVERY VEH	.300	.220	.080
8	TRUCK 2½ T MAINT	.270	.190	.060
9	TRAILER 1½ T MAINT	.270	.190	.060
10	PLT LDR CARRIER	.350	.250	.120
11	SQD CDR CARRIER	.350	.250	.120
12	TRUCK ¼ T PLT HQ	.270	.190	.060
13	TRAILER ½ T PLT HQ	.270	.190	.060
14	MORTAR SEC HQ CARRIER	.270	.190	.060
15	MORTAR CARRIER	.280	.200	.080
16	TOW CARRIER	.350	.250	.120
17	MG 7.62	.350	.250	.120
18	DRAGON ANTI TANK	.350	.250	.120
19	RIFLE 5.56	.350	.250	.120

Figure 2-17. Cumulative Probabilities of Materiel Degradation

In this example the commander's decision times for reconstitution of materiel and personnel are assumed to be 10 minutes and five minutes respectively. These decision times could have been derived from interviews with wartime company commanders.

2.2.4 Other Input

2.2.4.1 Times at which to evaluate capability

The user is able to specify times (in hours) at which to evaluate capability. Times of interest are determined by the analysis to be performed.

EXAMPLE: Times at which to evaluate capability

Capability will be determined every quarter hour up until six hours after attack.

2.2.4.2 Number of iterations

An integer greater than or equal to two must be entered as the number of iterations. Experience has shown that fifty iterations are generally sufficient to provide statistically significant convergence of results.

EXAMPLE: Number of iterations

Fifty iterations were used in the analysis of the mechanized infantry company.

2.2.4.3 Choke analysis flag

When this flag equals one, the choke analysis is performed and the results are printed. When the flag equals zero, the choke analysis is bypassed. (See paragraph 2.1.2.2)

2.2.4.4 Multiple optimal solution (MOS) flag

This option enables the user to specify the desired number of multiple optimal "choke" solutions to be derived for personnel and materiel by entering that number. An important exception is that the user must enter the value zero to obtain only one optimal solution. A value of one causes a search for all possible solutions. Normally, the user does not enter the value one due to the large amount of computer time consumed by a search for all possible solutions.

NOTE: The choke analysis flag must equal one in order to use this option. (See paragraph 2.1.2.3)

2.2.4.5 Assignment matrices flag

If this output option is chosen, then the assignment matrix, which contains the average assignment made in the unit reconstitution process, is printed. This variable is valued either zero or one. A value of one causes the calculation and output of personnel and materiel assignment matrices for all iterations with a common maximum number of teams. (See paragraph 2.1.2.4)

2.2.4.6 Mean time only flag

When this flag equals zero, the time required for personnel or materiel transfer, as well as repair times for materiel, are sampled from exponential distributions with means determined by the input data. When this flag equals one, the elements of the transfer matrices and the repair times are used as entered without the sampling process. (See paragraph 2.1.2.5)

2.2.4.7 Input only flag

When this flag equals one, the model will process and list input data without main program processing. When this flag equals zero, main program processing occurs and input data as well as selected output are printed.

2.2.5 Verification of Input

Good data processing techniques require that input data be verified as being correct prior to program execution. This is done in order to avoid costly computer reruns resulting from erroneous input. If the input only flag equals one, only the input data is printed in the order and format in which it was read. No further processing takes place, thereby permitting the user to check data for correctness.

Usually, an AMORE run is made for a unit using a zero PD set. This tests whether the input organization can do what it is designed to do by determining how many personnel and materiel teams can be built. If the required number of teams cannot be built, either the input data was entered wrong or designed incorrectly.

AMORE MODEL OUTPUT	REFERENCE SECTION
STANDARD OUTPUT.	2.3.2
1. Input Data	2.3.2.1
1. Flags and Times for Capability Calculations	
2. Personnel Data: Initial Strength	
3. Materiel Data: Initial Strength, Light and Moderate Damage Repair Times	
4. Transfer Matrix for Personnel	
5. Transfer Matrix for Materiel	
6. Personnel Required for Essential Teams	
7. Materiel Required for Essential Teams	
8. PD Set for Personnel	
9. PD Set for Materiel	
2. Output Data Results.	2.3.2.2
1. Capability at Selected Times	
2. Cumulative Area (Integral of Unit Capability) at Selected Times	
OPTIONAL RESULTS OUTPUT.	2.3.3
1. Choke Analysis Output: Sensitivity Analysis Needs and Surplus.	2.3.3.1
2. Multiple Optimal Solution (MOS) Output	2.3.3.2
3. Assignment Matrices Output	2.3.3.3
4. Mean Time Only Output.	2.3.3.4
5. Input Only Output.	2.3.3.5

Figure 2-18. AMORE Model Output

```
***** THIS IS AN INPUT CHECK RUN ONLY *****

          FLAGS ARE SET AS FOLLOWS
          0=NO   1=YES   >1=THAT NUMBER

          NUMBER OF ITERATIONS-  50

          CHOKE SENSITIVITY DATA 1

          ASSIGNMENT DATA 1

          ALTERNATE OPTIMAL SOLUTIONS 0

          USE MEAN TIMES ONLY 0


                                   TIMES FOR CAPABILITY CALCULATIONS ARE:
    0.250     0.500     0.750     1.000     1.250     1.500     1.750     2.000     2.250     2.500
    2.750     3.000     3.250     3.500     3.750     4.000     4.250     4.500     4.750     5.000
    5.250     5.500     5.750     6.000
```

Figure 2-19. Input Data Printout

PERSONNEL DATA

	TASK NAME	INITIAL STRENGTH
1	COMPANY CO	1
2	COMPANY XO	1
3	FIRST SGT	1
4	SUPPLY SGT	1
5	TAC COM CH	1
6	ARMORER	1
7	CARRIER DR	20
8	RTO	6
9	SUPPLYMAN	1
10	MOTOR SGT	1
11	SR REC OP	1
12	SR TRK MEH	1
13	MAINT CLK	1
14	COM OP MEH	1
15	REC VEH OP	1
16	TRK MEH	5
17	R PLT LDR	3
18	R PLT SGT	3
19	A PLT SGT	3
20	SQUAD LDR	9
21	TEAM LDR	18
22	AUTO RIFLE	18
23	GRENADIER	18
24	RIFLEMAN	27
25	W PLT LDR	1
26	W PLT SGT	1
27	M SEC LDR	1
28	FDC COMPT	2
29	M SQD LDR	3
30	MORT GNNR	6
31	AMMO BEAR	3
32	AT SEC LDR	1
33	AT SQD LDR	1
34	TOW GNNR	2
35	ASST GNNR	2

Figure 2-19. Input Data Printout (Continued)

MATERIEL DATA

	TYPE NAME	INITIAL SUPPLY	LIGHT REPAIR TIME	MODERATE REPAIR TIME
1	CO CARRIER	1	60	240
2	XO CARRIER	1	60	240
3	1/4T HQ	1	45	180
4	1/4T TLR	1	15	90
5	2-1/2T SUP	1	45	180
6	1-1/2T TLR	1	15	90
7	RECOVERY V	1	60	240
8	2-1/2T MNT	2	45	180
9	1-1/2T TLR	1	15	90
10	PL CARRIER	3	60	240
11	SL CARRIER	9	60	240
12	1/4T W PLT	2	45	180
13	1/4T TLR	2	15	90
14	HQ CARRIER	1	60	240
15	M CARRIER	3	60	240
16	T CARRIER	2	60	240
17	MG 7.62	15	30	180
18	DRAGON ATW	9	30	180
19	RIFLE 5.56	153	15	60

Figure 2-19. Input Data Printout (Continued)

TRANSFER MATRIX FOR PERSONNEL

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	0	0	0	30	.	.	0	0	0	.	30	.	30	.	10	.	0	0	0	0	0	0	0	0	0	0	0	15	0	15	0	0	0	10	0
2	0	0	0	30	.	.	0	0	0	.	30	.	30	.	10	.	0	0	0	0	0	0	0	0	0	0	0	15	0	15	0	0	0	10	0
3	15	0	0	30	.	.	0	0	0	10	30	.	30	.	10	.	0	0	0	0	0	0	0	0	30	15	15	15	0	15	0	0	0	10	0
4	.	.	60	0	.	0	.	0	0	.	.	.	10	.	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	10	20	5
5	.	.	60	30	0	.	.	0	0	.	.	.	10	0	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	10	20	5
6	.	.	.	30	.	0	.	10	0	.	.	.	10	.	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	30	5
7	.	.	.	.	.	.	0	0	10	.	30	.	.	.	10	30	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
8	.	.	.	.	.	.	.	0	10	.	.	.	.	30	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
9	.	.	.	60	.	30	.	10	0	.	.	.	10	.	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
10	.	.	60	30	.	30	0	0	0	0	0	0	0	.	0	0	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	10	20	5
11	.	.	.	.	.	.	0	0	0	30	0	30	10	.	0	0	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
12	.	.	.	.	.	30	0	0	0	30	10	0	10	.	0	0	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
13	.	.	.	60	.	.	.	10	0	.	.	.	0	.	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
14	.	.	.	.	30	.	.	0	10	.	.	.	30	0	.	10	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
15	.	.	.	.	.	.	0	0	10	60	10	60	30	.	0	.	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
16	.	.	.	.	.	60	0	10	10	.	30	30	30	.	10	0	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	.	.	5
17	30	15	15	30	.	.	0	0	0	.	30	.	30	.	10	.	0	0	0	0	0	0	0	0	10	0	0	15	0	15	0	0	0	10	0
18	60	30	30	.	.	.	0	0	0	.	30	.	30	.	10	.	0	0	0	0	0	0	0	0	30	15	15	30	0	15	0	0	0	10	0
19	.	.	.	.	.	.	0	0	0	.	30	.	30	.	10	.	30	10	0	0	0	0	0	0	60	30	30	.	0	15	0	0	10	30	0
20	.	.	.	.	.	.	0	0	0	.	.	.	.	.	.	.	.	30	10	0	0	0	0	0	.	.	.	.	.	.	0	30	10	30	5
21	.	.	.	.	.	.	0	0	0	.	.	.	.	.	.	.	.	60	30	10	0	0	0	0	.	.	.	.	.	.	0	.	.	.	5
22	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	10	0	0	0	.	.	.	.	.	.	0	.	.	.	5
23	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	10	0	0	0	.	.	.	.	.	.	0	.	.	.	5
24	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	30	0	0	0	.	.	.	.	.	.	0	.	.	.	5
25	30	15	15	30	.	.	0	0	0	10	30	.	30	.	10	.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0
26	60	30	30	.	.	.	0	0	0	.	30	.	30	.	10	.	15	10	0	0	0	15	15	0	0	0	0	0	0	0	0	0	0	10	0
27	.	.	.	.	.	.	0	0	0	.	30	.	30	.	10	.	.	30	10	30	10	15	15	0	30	10	0	0	0	0	0	10	0	10	5
28	.	.	.	.	.	.	.	0	0	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	30	0	0	10	10	0	.	.	.	5
29	.	.	.	.	.	.	0	0	0	.	.	.	.	.	.	.	.	.	.	.	30	15	15	0	.	.	10	10	0	0	0	15	10	15	5
30	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	.	30	30	10	0	0	30	.	.	5
31	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	10	0	.	.	.	5
32	.	.	.	.	.	.	0	0	0	.	30	.	30	.	10	.	.	30	10	30	10	15	15	0	30	10	10	10	10	10	0	0	0	0	0
33	.	.	.	.	.	.	0	0	0	.	.	.	.	.	.	.	.	.	.	.	30	15	15	0	.	30	30	30	30	15	0	10	0	0	0
34	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	30	0	10	0	0	0
35	.	.	.	.	.	.	10	10	10	.	.	.	.	.	.	.	.	.	.	.	.	15	15	0	.	.	.	.	.	.	0	.	10	0	0

Figure 2-19. Input Data Printout (Continued)

TRANSFER MATRIX FOR MATERIAL

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	0	0	.	30	.	.	30	.	0	0	0	.	0	30	.	.	.	.
2	0	0	0	.	30	.	.	30	.	0	0	0	.	0	30	.	.	.	.
3	.	.	0	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.
4	.	.	.	0	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.
5	.	.	30	.	0	.	.	10	.	.	.	30	.	.	.	.	.	.	.
6	.	.	.	.	.	0	.	.	0	.	.	.	.	.	.	.	.	.	.
7	.	.	10	.	.	.	0	.	.	.	.	10	.	.	.	.	.	.	.
8	.	.	30	.	10	.	.	0	.	.	.	30	.	.	.	.	.	.	.
9	.	.	.	.	.	0	.	.	0	.	.	.	.	.	.	.	.	.	.
10	10	10	0	.	30	.	.	30	.	0	0	0	.	0	30	.	.	.	.
11	10	10	0	.	30	.	.	30	.	0	0	0	.	0	30	.	.	.	.
12	.	.	10	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.	.
13	.	.	.	0	.	.	.	.	.	.	.	.	0	.	.	.	.	.	.
14	30	30	0	.	30	.	.	30	.	10	0	0	.	0	30	.	.	.	.
15	30	30	0	.	30	.	.	30	.	30	30	0	.	0	0	.	.	.	.
16	30	30	0	.	.	.	.	.	.	.	.	0	.	0	.	0	.	.	.
17	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.	.
18	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0	.
19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0

Figure 2-19. Input Data Printout (Continued)

PERSONNEL REQUIRED FOR MISSION 1

TASKS	ESSENTIALS FOR TEAM 1	ESSENTIALS FOR TEAM 2	ESSENTIALS FOR TEAM 3	ESSENTIALS FOR TEAM 4	ESSENTIALS FOR TEAM 5	ESSENTIALS FOR TEAM 6	ESSENTIALS FOR TEAM 7	ESSENTIALS FOR TEAM 8
1	0	0	0	0	0	0	1	1
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	1	2	3	4	5	6	7	8
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	1	1
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	1	1
16	0	0	0	0	0	0	2	2
17	0	0	1	1	1	1	1	1
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	1	1	2	2	3	3	4
21	1	2	3	4	5	6	7	8
22	1	2	3	4	5	6	7	8
23	1	2	3	4	5	6	7	8
24	1	2	3	4	5	6	7	8
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	0	0	0	0	1	1	1	1
30	0	0	0	0	2	2	2	2
31	0	0	0	0	0	0	0	0
32	0	1	1	1	1	1	1	1
33	0	0	0	0	0	0	0	0
34	0	1	1	1	1	1	1	1
35	0	0	0	0	0	0	0	0

Figure 2-19. Input Data Printout (Continued)

PERSONNEL REQUIRED FOR MISSION 1

TASKS	ESSENTIALS FOR TEAM 9	ESSENTIALS FOR TEAM 10	ESSENTIALS FOR TEAM 11	ESSENTIALS FOR TEAM 12	ESSENTIALS FOR TEAM 13	ESSENTIALS FOR TEAM 14	ESSENTIALS FOR TEAM 15	ESSENTIALS FOR TEAM 16
1	1	1	1	1	1	1	1	1
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	9	10	11	12	13	14	15	16
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	1	1	1	1	1	1	1	1
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	1	1	1	1	1	1	1	1
16	2	2	2	2	2	2	2	2
17	2	2	2	2	2	2	3	3
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	4	5	5	6	6	7	7	8
21	9	10	11	12	13	14	15	16
22	9	10	11	12	13	14	15	16
23	9	10	11	12	13	14	15	16
24	9	10	11	12	13	14	15	16
25	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0
29	1	1	1	1	2	2	2	2
30	2	2	2	2	4	4	4	4
31	0	0	0	0	0	0	0	0
32	1	1	1	1	1	1	1	1
33	0	0	1	1	1	1	1	1
34	1	1	2	2	2	2	2	2
35	0	0	0	0	0	0	0	0

Figure 2-19. Input Data Printout (Continued)

PERSONNEL REQUIRED FOR MISSION 1

TASKS	ESSENTIALS FOR TEAM 17	ESSENTIALS FOR TEAM 18
1	1	1
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	17	18
8	0	0
9	0	0
10	1	1
11	0	0
12	0	0
13	0	0
14	0	0
15	1	1
16	2	2
17	3	3
18	0	0
19	0	0
20	8	9
21	17	18
22	17	18
23	17	18
24	17	18
25	0	0
26	0	0
27	0	0
28	0	0
29	3	3
30	6	6
31	0	0
32	1	1
33	1	1
34	2	2
35	0	0

Figure 2-19. Input Data Printout (Continued)

MATERIEL REQUIRED FOR MISSION 1

TASKS	ESSENTIALS FOR TEAM 1	ESSENTIALS FOR TEAM 2	ESSENTIALS FOR TEAM 3	ESSENTIALS FOR TEAM 4	ESSENTIALS FOR TEAM 5	ESSENTIALS FOR TEAM 6	ESSENTIALS FOR TEAM 7	ESSENTIALS FOR TEAM 8
1	0	0	0	0	0	0	1	1
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	1	1
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	1	1	1	1	1	1
11	1	1	1	2	2	3	3	4
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	0	0	0	0	1	1	1	1
16	0	1	1	1	1	1	1	1
17	1	1	2	3	3	4	5	6
18	0	1	1	2	2	3	3	4
19	5	13	19	25	33	39	47	53

Figure 2-19. Input Data Printout (Continued)

MATERIEL REQUIRED FOR MISSION 1

TASKS	ESSENTIALS FOR TEAM 9	ESSENTIALS FOR TEAM 10	ESSENTIALS FOR TEAM 11	ESSENTIALS FOR TEAM 12	ESSENTIALS FOR TEAM 13	ESSENTIALS FOR TEAM 14	ESSENTIALS FOR TEAM 15	ESSENTIALS FOR TEAM 16
1	1	1	1	1	1	1	1	1
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	1	1	1	1	1	1	1	1
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	2	2	2	2	2	2	3	3
11	4	5	5	6	6	7	7	8
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	1	1	1	1	2	2	2	2
16	1	1	2	2	2	2	2	2
17	7	8	8	9	9	10	11	12
18	4	5	5	6	6	7	7	8
19	59	65	72	78	86	92	98	104

Figure 2-19. Input Data Printout (Continued)

MATERIEL REQUIRED FOR MISSION 1

TASKS	ESSENTIALS FOR TEAM 17	ESSENTIALS FOR TEAM 18
1	1	1
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	1	1
8	0	0
9	0	0
10	3	3
11	8	9
12	0	0
13	0	0
14	0	0
15	3	3
16	2	2
17	12	13
18	8	9
19	112	118

Figure 2-19. Input Data Printout (Continued)

DAMAGE PROBABILITIES FOR SET 1
THE MECHANIZED INFANTRY COMPANY CONDUCTING THE ATTACK MISSION

PERSONNEL DAMAGE LEVELS BY TASK

INDEX	TASK NAME	DELAY(MINUTES)	DAMAGE PROBABILITY(=)
1	COMPANY CO	5	.1500
2	COMPANY XO	5	.1300
3	FIRST SGT	5	.1300
4	SUPPLY SGT	5	.1300
5	TAC COM CH	5	.1300
6	ARMORER	5	.1300
7	CARRIER DR	5	.1800
8	RTO	5	.1300
9	SUPPLYMAN	5	.1300
10	MOTOR SGT	5	.1500
11	SR REC OP	5	.1300
12	SR TRK MEH	5	.1300
13	MAINT CLK	5	.1300
14	COM OP MEH	5	.1300
15	REC VEH OP	5	.1500
16	TRK MEH	5	.1500
17	R PLT LDR	5	.1800
18	R PLT SGT	5	.1300
19	A PLT SGT	5	.1300
20	SQUAD LDR	5	.1800
21	TEAM LDR	5	.1800
22	AUTO RIFLE	5	.1800
23	GRENADIER	5	.1800
24	RIFLEMAN	5	.1800
25	W PLT LDR	5	.1300
26	W PLT SGT	5	.1300
27	M SEC LDR	5	.1400
28	FDC COMPT	5	.1300
29	M SQD LDR	5	.1400
30	MORT GNNR	5	.1400
31	AMMO BEAR	5	.1300
32	AT SEC LDR	5	.1800
33	AT SQD LDR	5	.1800
34	TOW GNNR	5	.1800
35	ASST GNNR	5	.1800

Figure 2-19. Input Data Printout (Continued)

MATERIEL DAMAGE LEVELS BY TYPE

INDEX	TYPE NAME	DELAY(MINUTES)	CUMULATIVE DAMAGE(=) LIGHT	MODERATE	SEVERE	NONCUMULATIVE DAMAGE(=) LIGHT	MODERATE	SEVERE
1	CO CARRIER	10	.300	.220	.080	.080	.140	.080
2	XO CARRIER	10	.270	.190	.060	.080	.130	.060
3	1/4T HQ	10	.270	.190	.060	.080	.130	.060
4	1/4T TLR	10	.270	.190	.060	.080	.130	.060
5	2-1/2T SUP	10	.270	.190	.060	.080	.130	.060
6	1-1/2T TLR	10	.270	.190	.060	.080	.130	.060
7	RECOVERY V	10	.300	.220	.080	.080	.140	.080
8	2-1/2T MNT	10	.270	.190	.060	.080	.130	.060
9	1-1/2T TLR	10	.270	.190	.060	.080	.130	.060
10	PL CARRIER	10	.350	.250	.120	.100	.130	.120
11	SL CARRIER	10	.350	.250	.120	.100	.130	.120
12	1/4T W PLT	10	.270	.190	.060	.080	.130	.060
13	1/4T TLR	10	.270	.190	.060	.080	.130	.060
14	HQ CARRIER	10	.270	.190	.060	.080	.130	.060
15	M CARRIER	10	.280	.200	.080	.080	.120	.080
16	T CARRIER	10	.350	.250	.120	.100	.130	.120
17	MG 7.62	10	.350	.250	.120	.100	.130	.120
18	DRAGON ATW	10	.350	.250	.120	.100	.130	.120
19	RIFLE 5.56	10	.350	.250	.120	.100	.130	.120

Figure 2-19. Input Data Printout (Continued)

On the other hand, an organization with zero PDs may be able to build more teams than was originally perceived. In this case, the user may wish to modify the initial strengths or the requirements for essential teams.

2.3 AMORE MODEL OUTPUT

2.3.1 Introduction

This portion of the user's manual is designed to provide the user with an understanding of the various forms of output produced by program AMORE. With this knowledge, the user will be able to more effectively perform solution analyses. However, detailed discussion on output analysis techniques will not be conducted as it is beyond the intended scope of this manual.

All sample output in this section applies to the mechanized infantry company example problems. AMORE Model Output is listed in Figure 2-18.

2.3.2 Standard Output

2.3.2.1 Input Data

Input data for each AMORE run is always printed for verification by the user. If the Input Only Flag is on, then the simulation is not made and only the input data is printed. Otherwise, both the input data and the analysis results are printed. The output format of the input data is the same in either case. Sample printouts are provided in Figure 2-19.

2.3.2.2 Results

The second portion of the standard output consists of two forms of the end of run statistics for each mission. The first, shown in Figure 2-20, contains the mean fraction of capability for personnel and materiel. These capabilities are evaluated at each of the user's specified time slices, and at zero, minimum, and infinite times. The unit capability, labelled "minimum" on the printout because it is the average for all iterations of the minimum of the personnel and materiel capabilities, is also included. To illustrate how to read the output, note that after 0.75 hours, personnel regained a mean capability of 100 percent, while materiel reached only a mean capability of 42.9 percent with minimum or unit mean capability being 42.9 percent at that time. A 90 percent confidence limit is also shown for each of the mean capabilities.

The second form (Figure 2-21) contains information on the average cumulative area under the unit capability curve (the integral of unit capability with respect to time). This area is presented in terms of unit hours and team hours available from the start of reorganizations to the time of interest. For example, a full-up unit at 100 percent capability would have one unit hour available in one hour. If that unit had ten teams it would have ten team hours available in one hour. The example case has only 0.389 unit hours available in the first hour or only 7.005 team hours from an eighteen team unit.

2.3.3 Optional Results Output

2.3.3.1 Choke analysis output

A choke analysis is performed for each iteration with a maximum number of teams less than the total number of teams. This analysis

THE MECHANIZED INFANTRY COMPANY CONDUCTING THE ATTACK MISSION
MEAN CAPABILITIES

TIME (HOURS)	MISSION 1 PERSONNEL		MATERIEL		MINIMUM	
0.000	.441	.059	.343	.043	.253	.043
MINIMUM	.436	.061	.343	.043	.252	.043
0.250	.857	.054	.384	.046	.362	.046
0.500	.992	.046	.407	.050	.407	.050
0.750	1.000	.000	.429	.051	.429	.051
1.000	1.000	.000	.466	.051	.466	.051
1.250	1.000	.000	.496	.053	.496	.053
1.500	1.000	.000	.529	.056	.529	.056
1.750	1.000	.000	.539	.058	.539	.058
2.000	1.000	.000	.562	.053	.562	.053
2.250	1.000	.000	.578	.056	.578	.056
2.500	1.000	.000	.591	.055	.591	.055
2.750	1.000	.000	.611	.052	.611	.052
3.000	1.000	.000	.613	.052	.613	.052
3.250	1.000	.000	.617	.053	.617	.053
3.500	1.000	.000	.619	.053	.619	.053
3.750	1.000	.000	.622	.054	.622	.054
4.000	1.000	.000	.632	.053	.632	.053
4.250	1.000	.000	.647	.054	.647	.054
4.500	1.000	.000	.657	.055	.657	.055
4.750	1.000	.000	.680	.054	.680	.054
5.000	1.000	.000	.684	.055	.684	.055
5.250	1.000	.000	.689	.055	.689	.055
5.500	1.000	.000	.703	.055	.703	.055
5.750	1.000	.000	.703	.055	.703	.055
6.000	1.000	.000	.703	.055	.703	.055
INFINITY	1.000	.000	.759	.051	.759	.051

ITERATIONS 50

TWO SIDED 90 PERCENT CONFIDENCE LIMITS ARE TO THE RIGHT OF EACH COLUMN

Figure 2-20. Unit Capability Over Time

CUMULATIVE AREA
TIME VERSUS TEAMS BUILT

MISSION 1

TIME (HOURS)	UNIT CAPABILITY	UNIT HOURS	TEAM HOURS
MINIMUM	0.252	0.000	0.000
0.250	0.362	0.077	1.383
0.500	0.407	0.173	3.113
0.750	0.429	0.277	4.993
1.000	0.466	0.389	7.005
1.250	0.496	0.509	9.168
1.500	0.529	0.637	11.473
1.750	0.539	0.771	13.875
2.000	0.562	0.908	16.353
2.250	0.578	1.051	18.918
2.500	0.591	1.197	21.548
2.750	0.611	1.347	24.253
3.000	0.613	1.500	27.008
3.250	0.617	1.654	29.775
3.500	0.619	1.809	32.555
3.750	0.622	1.964	35.348
4.000	0.632	2.121	38.170
4.250	0.647	2.280	41.048
4.500	0.657	2.443	43.980
4.750	0.680	2.610	46.988
5.000	0.684	2.781	50.058
5.250	0.689	2.953	53.148
5.500	0.703	3.127	56.280
5.750	0.703	3.303	59.445
6.000	0.703	3.478	62.610

Figure 2-21. Integral of Unit Capability Over Time

ascertains the personnel skill groups and equipment type which would have been needed in order to build one more team. The output is labelled "Sensitivity Analysis Needs and Surplus" and it includes the average needs, the average surplus, and the standard deviation of these averages. The number of the team attempted (one beyond the optimal solution team) is given at the top of the page and the number of iterations for which this 'next' team was attempted appears at the bottom.

Figure 2-22 is an example of Choke Analysis Output. It shows that the sixteenth team was attempted seven times using "dummy" resources following a like number of optimal solutions resulting in a maximum capability of fifteen teams. Note that a lack of materiel items 17 and 18 caused this to happen. On the average, team 16 required 0.14 of "dummy" item 17, the MG 7.62. However, an average of 0.86 "dummy" DRAGON, item 18, was required. In other words, in one of the seven iterations a MG 7.62 was needed to build the sixteenth team while the remaining six iterations required a DRAGON.

For those iterations where the total number of teams (eighteen in this case) can be built, the "next" team increment solution is not required. Therefore, the needs are not necessary and only a tally of average surplus and standard deviation of surplus is printed (Figure 2-23). Those surpluses are labelled "AFTER LAST TEAM."

2.3.3.2 Multiple optimal solution (MOS) output

The multiple optimal solution option provides the ability to examine each of the "choke" solutions for alternate optimal solutions. A sample of the output provided when this option is exercised is provided at Figure 2-24. The MOS output is directly comparable to choke analysis output with the same team number. In the sample case, six more solutions than the number of iterations were found. In cases

with multiple solutions, average needs and surpluses may vary a great deal between the MOS and the choke analysis output. When no other solutions are found, the number of iterations equals the number of solutions and a comparison of the average needs and surpluses in the two figures shows exactly the same results.

The minimum and maximum values are derived considering all solutions found. The averages result from averaging all solutions found on each iteration and when all iterations are complete an average per iteration is calculated. This results in a weighted average solution where a solution with no alternates is weighted heavier than one with several alternates.

2.3.3.3 Assignment matrices output

Assignment matrices for each mission consist of the average assignment of survivors for those iterations used to build a particular maximum number of teams. For example Figure 2-25 depicts the average assignment of materiel resources which built a maximum of fifteen teams. Note that this solution occurred seven times. The two columns to the far right summarize the unassigned (SURPLUS) and the TOTAL (assigned and SURPLUS) resources surviving per row.

A great deal of information can be gleaned from each one of the assignment matrices. To illustrate this, two representative samples, materiel items 2 and 16 in Figure 2-25 are examined to reveal the type of information that can be extracted for analysis purposes.

A look at materiel item 2 (XO Carrier) (which is not required in the fifteenth essential materiel team) shows that an average of 0.29 (out of one) of them was substituted for materiel item 1 (CO Carrier). Also, an average of 0.14 (out of one) XO Carriers is

substituted for materiel type 10 (PL Carrier) and an average of 0.14 (out of one) is substituted for materiel type 11 (SL Carrier). Additionally, an average of 0.29 XO carriers were substituted for materiel type 10 even after suffering moderate damage. An examination of the TOTAL column through the moderate damage level reveals that only an average of 0.86 XO Carriers survived altogether. This indicates that an average of 0.14 XO Carriers suffered at least severe damage and could not be used.

Recall that two TOW Carriers (materiel type 16) are required by the fifteenth essential materiel team. A close examination of the assignment matrix shows that an average of 1.14 (1.14/2 = 0.57 or 57 percent of the time) TOW Carriers survived undamaged and remained assigned to the original task. An inspection of the diagonal elements of the light and moderate damage matrices reveals that TOW carriers were damaged, repaired and returned to the unit. Of these reassigned TOW carriers 0.14 (seven percent) suffered light damage and about 0.71 (36 percent suffered moderate damage. Note that the TOTAL column through the moderate damage level reveals that an average of 2.00 (one-hundred percent) TOW carriers survived.

2.3.3.4 Mean time only output

The general method for determining operational time of an asset is to use a random exponential sampling of time based on the input mean or expected times. The mean time only option can be used to eliminate the exponential random sampling of time in the simulation. Figure 2-26 is an example which is directly comparable to Figure 2-20. A comparison of these figures shows the effect of the random sampling of time.

2.3.3.5 Input only output

A printout of all input data can be obtained without analyzing the data by using the input only option. A sample printout was included in Section 2.3.2.1.

THE MECHANIZED INFANTRY COMPANY CONDUCTING THE ATTACK MISSION
SENSITIVITY ANALYSIS NEEDS AND SURPLUS CONTINUED
MISSION 1
MATERIEL

	TEAM 15				TEAM 16			
	NEEDS		SURPLUS		NEEDS		SURPLUS	
TYPE	AVERAGE	ST. DEVIATION	AVERAGE	ST. DEVIATION	AVERAGE	ST. DEVIATION	AVERAGE	ST. DEVIATION
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.49
4	0.00	0.00	1.00	0.00	0.00	0.00	0.86	0.38
5	0.00	0.00	1.00	0.00	0.00	0.00	0.57	0.53
6	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	1.00	0.00	0.00	0.00	1.14	0.69
9	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.49
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	1.00	0.00	0.00	0.00	1.43	0.53
13	0.00	0.00	1.00	0.00	0.00	0.00	1.43	0.53
14	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.38
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	1.00	0.00	0.00	0.00	0.14	0.38	0.00	0.00
18	0.00	0.00	0.00	0.00	0.86	0.38	0.00	0.00
19	0.00	0.00	6.00	0.00	0.00	0.00	1.00	1.73
LIGHT								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.38
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.38
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.49
9	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.38
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.38
13	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.49
14	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.76
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	10.00	0.00	0.00	0.00	12.57	3.82
MODERATE								
1	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	1.00	0.00	0.00	0.00	0.14	0.38
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	1.00	0.00	0.00	0.00	0.29	0.76
9	0.00	0.00	1.00	0.00	0.00	0.00	0.14	0.38
10	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.38
11	0.00	0.00	1.00	0.00	0.00	0.00	0.86	1.21
12	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.49
13	0.00	0.00	1.00	0.00	0.00	0.00	0.29	0.49
14	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.38
15	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	9.00	0.00	0.00	0.00	1.57	1.51
18	0.00	0.00	1.00	0.00	0.00	0.00	0.14	0.38
19	0.00	0.00	13.00	0.00	0.00	0.00	18.29	2.21
	NUMBER OF ITERATIONS 1.				NUMBER OF ITERATIONS 7.			

Figure 2-22. Choke Analysis Data - Teams 15 & 16

THE MECHANIZED INFANTRY COMPANY CONDUCTING THE ATT
SENSITIVITY ANALYSIS NEEDS AND SURPLUS CONTINUED
MISSION 1
MATERIEL

AFTER LAST TEAM

TYPE	SURPLUS AVERAGE	SURPLUS ST. DEVIATION
1	0.00	0.00
2	0.00	0.00
3	0.60	0.55
4	0.80	0.45
5	0.80	0.45
6	0.80	0.45
7	0.00	0.00
8	1.60	0.55
9	0.80	0.45
10	0.00	0.00
11	0.00	0.00
12	1.40	0.89
13	2.00	0.00
14	0.00	0.00
15	0.00	0.00
16	0.00	0.00
17	0.00	0.00
18	0.00	0.00
19	0.00	0.00
LIGHT		
1	0.00	0.00
2	0.00	0.00
3	0.00	0.00
4	0.00	0.00
5	0.00	0.00
6	0.00	0.00
7	0.00	0.00
8	0.20	0.45
9	0.00	0.00
10	0.00	0.00
11	0.00	0.00
12	0.00	0.00
13	0.00	0.00
14	0.00	0.00
15	0.00	0.00
16	0.00	0.00
17	0.20	0.45
18	0.00	0.00
19	0.60	1.34
MODERATE		
1	0.00	0.00
2	0.00	0.00
3	0.40	0.55
4	0.00	0.00
5	0.00	0.00
6	0.20	0.45
7	0.00	0.00
8	0.00	0.00
9	0.00	0.00
10	0.00	0.00
11	0.20	0.45
12	0.40	0.89
13	0.00	0.00
14	0.00	0.00
15	0.00	0.00
16	0.00	0.00
17	0.80	0.45
18	0.00	0.00
19	11.80	4.66

NUMBER OF ITERATIONS 5.

Figure 2-23. Choke Analysis Data for Cases When All Teams Completed

THE MECHANIZED INFANTRY COMPANY CONDUCTING THE ATTACK MISSION(ALTER SOLUTIONS) PAGE 24
SENSITIVITY ANALYSIS NEEDS AND SURPLUS CONTINUED
MISSION 1
MATERIEL

TEAM 18

	NEEDS				SURPLUS			
TYPE	MINIMUM	AVERAGE	MAXIMUM	ST.DEVIATION,	MINIMUM	AVERAGE	MAXIMUM	ST. DEVIATION
1	0.00	0.03	1.00	0.11	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.77	1.00	0.44
4	0.00	0.00	0.00	0.00	0.00	0.85	1.00	0.38
5	0.00	0.00	0.00	0.00	0.00	0.77	1.00	0.44
6	0.00	0.00	0.00	0.00	0.00	0.62	1.00	0.51
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	1.38	2.00	0.77
9	0.00	0.00	0.00	0.00	0.00	0.77	1.00	0.44
10	0.00	0.09	1.00	0.19	0.00	0.00	0.00	0.00
11	0.00	0.11	1.00	0.21	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	1.46	2.00	0.66
13	0.00	0.00	0.00	0.00	0.00	1.38	2.00	0.65
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.08	1.00	0.28	0.00	0.00	0.00	0.00
18	0.00	0.85	1.00	0.38	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LIGHT								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.08	1.00	0.28
4	0.00	0.00	0.00	0.00	0.00	0.08	1.00	0.28
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.08	1.00	0.28
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.15	2.00	0.55
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.15	1.00	0.38
13	0.00	0.00	0.00	0.00	0.00	0.15	1.00	0.38
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.38	3.00	0.96
MODERATE								
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.08	1.00	0.28
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.23	1.00	0.44
6	0.00	0.00	0.00	0.00	0.00	0.23	1.00	0.44
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.46	2.00	0.66
9	0.00	0.00	0.00	0.00	0.00	0.15	1.00	0.38
10	0.00	0.00	0.00	0.00	0.00	0.08	1.00	0.28
11	0.00	0.00	0.00	0.00	0.00	0.15	1.00	0.38
12	0.00	0.00	0.00	0.00	0.00	0.23	1.00	0.44
13	0.00	0.00	0.00	0.00	0.00	0.23	1.00	0.44
14	0.00	0.00	0.00	0.00	0.00	0.23	1.00	0.44
15	0.00	0.00	0.00	0.00	0.00	0.08	1.00	0.28
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.69	2.00	0.63
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	10.00	16.31	22.00	4.25

NUMBER OF ITERATIONS 13.
TOTAL SOLUTIONS CONSIDERED 19.

Figure 2-24. Choke Analysis Data-Alternate Optional Solution Format

THE MECHANIZED INFANTRY COMPANY CONDUCTING THE ATTACK MISSION
SENSITIVITY ANALYSIS ASSIGNMENT MATRIX
MISSION 1
MATERIAL

TEAM 15

TYPE	1	2	3	4	5	6	7	8	9	10	11	12	13
1	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.29	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.43	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00
LIGHT													
1	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.57	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MODERATE													
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 2-25. Assignment Data for Build of Fifteen Teams.

TYPE	14	15	16	17	18	19	SURPLUS	TOTAL	
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	1
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	2
3	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.71	3
4	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.86	4
5	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.57	5
6	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	6
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	7
8	0.00	0.00	0.00	0.00	0.00	0.00	1.14	1.14	8
9	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.71	9
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	10
11	0.00	0.00	0.00	0.00	0.00	0.00	0.14	5.43	11
12	0.00	0.00	0.00	0.00	0.00	0.00	1.43	1.43	12
13	0.00	0.00	0.00	0.00	0.00	0.00	1.43	1.43	13
14	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.71	14
15	0.00	1.86	0.00	0.00	0.00	0.00	0.14	2.29	15
16	0.00	0.00	1.14	0.00	0.00	0.00	0.00	1.14	16
17	0.00	0.00	0.00	9.14	0.00	0.00	0.14	9.29	17
18	0.00	0.00	0.00	0.00	5.86	0.00	0.00	5.86	18
19	0.00	0.00	0.00	0.00	0.00	97.86	5.29	103.14	19
LIGHT									
1	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.86	1
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.57	2
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	3
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	4
5	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.71	5
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	6
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	7
8	0.00	0.00	0.00	0.00	0.00	0.00	0.29	1.43	8
9	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.86	9
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	10
11	0.00	0.00	0.00	0.00	0.00	0.00	0.14	6.43	11
12	0.00	0.00	0.00	0.00	0.00	0.00	0.14	1.57	12
13	0.00	0.00	0.00	0.00	0.00	0.00	0.29	1.71	13
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	14
15	0.00	0.14	0.00	0.00	0.00	0.00	0.14	2.57	15
16	0.00	0.00	0.14	0.00	0.00	0.00	0.00	1.29	16
17	0.00	0.00	0.00	1.57	0.00	0.00	0.29	11.14	17
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.86	18
19	0.00	0.00	0.00	0.00	0.00	0.14	14.29	117.57	19
MODERATE									
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	1
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	2
3	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.86	3
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	4
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	5
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	6
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	7
8	0.00	0.00	0.00	0.00	0.00	0.00	0.29	1.71	8
9	0.00	0.00	0.00	0.00	0.00	0.00	0.14	1.00	9
10	0.00	0.00	0.00	0.00	0.00	0.00	0.14	2.29	10
11	0.00	0.00	0.00	0.00	0.00	0.00	1.14	7.86	11
12	0.00	0.00	0.00	0.00	0.00	0.00	0.29	1.86	12
13	0.00	0.00	0.00	0.00	0.00	0.00	0.29	2.00	13
14	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.86	14
15	0.00	0.00	0.00	0.00	0.00	0.00	0.14	2.71	15
16	0.00	0.00	0.71	0.00	0.00	0.00	0.00	2.00	16
17	0.00	0.00	0.00	0.29	0.00	0.00	2.29	13.71	17
18	0.00	0.00	0.00	0.00	1.14	0.00	0.29	7.29	18
19	0.00	0.00	0.00	0.00	0.00	0.00	10.29	135.86	19

NUMBER OF ITERATIONS 7.

Figure 2-25. Assignment Data for Build of Fifteen Teams (Continued)

THE MECHANIZED INFANTRY COMPANY CONDUCTING THE ATTACK MISSION
MEAN CAPABILITIES

TIME (HOURS)	PERSONNEL		MISSION 1 MATERIEL		MINIMUM	
0.000	.441	.059	.343	.043	.258	.043
MINIMUM	.436	.061	.343	.043	.252	.043
0.250	.987	.022	.364	.045	.364	.045
0.500	.987	.022	.368	.046	.368	.046
0.750	1.000	.000	.386	.049	.386	.049
1.000	1.000	.000	.386	.049	.386	.049
1.250	1.000	.000	.484	.050	.484	.050
1.500	1.000	.000	.484	.050	.484	.050
1.750	1.000	.000	.488	.051	.488	.051
2.000	1.000	.000	.488	.051	.488	.051
2.250	1.000	.000	.488	.051	.488	.051
2.500	1.000	.000	.488	.051	.488	.051
2.750	1.000	.000	.488	.051	.488	.051
3.000	1.000	.000	.488	.051	.488	.051
3.250	1.000	.000	.517	.058	.517	.058
3.500	1.000	.000	.517	.058	.517	.058
3.750	1.000	.000	.517	.058	.517	.058
4.000	1.000	.000	.517	.058	.517	.058
4.250	1.000	.000	.758	.051	.758	.051
4.500	1.000	.000	.758	.051	.758	.051
4.750	1.000	.000	.759	.051	.759	.051
5.000	1.000	.000	.759	.051	.759	.051
5.250	1.000	.000	.759	.051	.759	.051
5.500	1.000	.000	.759	.051	.759	.051
5.750	1.000	.000	.759	.051	.759	.051
6.000	1.000	.000	.759	.051	.759	.051
INFINITY	1.000	.000	.759	.051	.759	.051

ITERATIONS 50

TWO SIDED 90 PERCENT CONFIDENCE LIMITS ARE TO THE RIGHT OF EACH COLUMN

Figure 2-26. Unit Capability Over Time Using Input Mean Times

CHAPTER 3

ANALYST - PROGRAMMER INTERFACE

3.1 INTRODUCTION

In order to properly input data for any computer program, the data must conform to particular computer language specifications and must be entered in a specific order. For the AMORE computer program, the input data must conform to formats and specifications of the FORTRAN computer language. This chapter provides the bridge between developing the input data (Chapter 2) and entering it into a computer.

The following section contains specific information needed to prepare the input data for model entry. The section is subdivided by data card type (logical record). The card type numbers indicate the sequencing order of the input data. Each subdivision contains a brief discussion of the items on the card, a summary of the card input format, and a sample card image. Within each card type input format summary, the data items contained therein are progressively numbered for column usage from left to right. For each item's column usage, a specific FORTRAN format, variable name and brief description corresponding to that discussed earlier are displayed. The values used in the sample card images come from the mechanized infantry company example of Chapter 2. Note that a "Δ" denotes a blank space.

Whether batch processing (card input) or time sharing via remote terminal are used, the same formatting for input must be used. Therefore, the formatting instructions apply to both batch and remote terminal processing and must be adhered to.

3.2 CARD INPUT FORMATS AND IMAGES

3.2.1 Card Type 1.

This card image is used to initialize six processing parameters. The first is the number of iterations to be executed. For the example problem, fifty iterations were considered sufficient to provide statistically correct results (ITRATE = 50). The second controls whether or not an analysis of "choke" data is to be provided as output. In accordance with the problem statement, "choke" data is required (SCHOKE = 1). The third parameter governs the optional printing of the assignment table(s). This is required as part of the problem solution (ASSIGN = 1). The fourth parameter controls the number of solutions that are to be derived For this exercise assume no alternate solutions are desired for choke analysis (MULTF = 0). The fifth parameter controls whether fixed transfer times or statistically determined transfer times would be used for calculation of capability. For this solution a random distribution of the transfer times is desired (IMEANT = 0). The last (sixth parameter) permits the user to have the program print input data without further processing in order to verify data correctness without wasting valuable computer run time. The use of good data processing techniques such as this is highly desired and is used in this example (IONLY = 1). Following verification of the input, the value of IONLY can then be changed to zero for program execution.

Input formats and a sample card image appear in Figure 3-1. These inputs are discussed in Sections 2.2.4.2 through 2.2.4.7.

CARD TYPE = 1	FLAGS (RUN CONTROL AND PROCESSING PARAMETERS) (ONE CARD)				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
				NOTE: Standard output for any run is the "capability over time" tables; all other output is optional.	
1	1-5	I5	ITRATE	ITERATION FLAG No. of iterations of the model estimated to produce statistically meaningful results. This value must be greater than or equal to two for proper program execution.	50
2	6-10	I5	SCHOKE	CHOKE FLAG If SCHOKE=1, perform choke analysis; print "needs & surplus" tables. If MULTF > 0 find alternate optimal solutions if they exist. If SCHOKE=0, bypass choke analysis.	1
3	11-15	I5	ASSIGN	ASSIGNMENT MATRIX FLAG If ASSIGN=1, print the assignment table for the optimal allocation of available resources to make teams. If ASSIGN=0, bypass these procedures.	1
4	16-20	I5	MULTF	MULTIPLE OPTIMAL SOLUTION (MOS FLAG) MOS's are alternate allocations having the same time cost (transportation algorithm); applies only to the choke analysis. If MULTF=1, find as many solutions as possible & average. If MULTF > 1, search for MULTF solutions & average. If MULTF=0, find only one solution.	0
5	21-25	I5	IMEANT	MEAN TIMES ONLY FLAG If IMEANT=0, calculate capability over time using randomized mean transfer times (standard run); if IMEANT=1, use input mean times.	0
6	26-30	I5	IONLY	INPUT ONLY FLAG If IONLY=1, list inputs without processing them. If IONLY=0, processing occurs & input data as well as selected output are printed	1
	31-80	50X	---	Blank	Blank

/ΔΔΔ50ΔΔΔΔ1ΔΔΔΔ1ΔΔΔΔ0ΔΔΔΔ0ΔΔΔΔ1... /

CARD TYPE 1 IMAGE

Figure 3-1. Card Type 1 Input Format and Sample Card Image

3.2.2 Card Type 2

The purpose of this card is to input the number of time slices at which capability after degradation is to be evaluated. In this case, measurements are to be taken at quarter hour intervals for six hours or (6 x 4 = 24) time slices. The capability at zero, minimum, and infinite times are automatically calculated and therefore are not included in the summation of time slices.

Input formats and a sample card image appear in Figure 3-2.

CARD TYPE =2	NUMBER OF TIME SLICES THIS RUN (ONE CARD)				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
1	1-5	I5	NTIMES	No. of times unit capability will be assessed after initial degradation.	24
	6-80	75X	---	Blank	Blank

....24....

CARD TYPE 2 IMAGE

Figure 3-2. Card Type 2 Input Format and Sample Card Image.

3.2.3 Card Type 3

This card inputs the time slices at which capability measurements are to be taken following degradation. For the twenty-four quarter hour slices, measurements are to be taken at 0.25, 0.50, 0.75, ..., 5.75 and 6.00 hours following degradation. The following format is used to input these time slices. Note that only eight times per card can be entered. Therefore three cards are used.

Input formats and a sample card image appear in Figure 3-3. This input is discussed in Section 2.2.4.1.

CARD TYPE #3	SPECIFICATION OF TIME SLICES (NTIMES VALUES, 8 VALUES/CARD) Hours elapsed from time zero, at which time, capability is to be measured				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
				Note: All values must include a decimal point, e.g., 1.0 hrs or .10 hrs. The TIMES values must be in ascending order.	
1	1-10	F10.0	TIMES(1)	First time of interest.	0.25
2	11-20	F10.0	TIMES(2)	Second time of interest.	0.50
⋮	⋮	⋮	⋮	⋮	⋮
8	71-80	F10.0	TIMES(8)	Eighth time of interest (last time this card).	2.00
9	1-10	F10.0	TIMES(9)	Nineth time of interest	2.25
⋮	⋮	⋮	⋮	⋮	⋮
16	71-80	F10.0	TIMES(16)	Sixteenth time of interest (last time this card).	4.00
17	1-10	F10.0	TIMES(17)	Seventeenth time of interest	4.25
					⋮
NTIMES	-	F10.0	TIMES(NTIMES)	Last time of interest (last time this card).	6.00

Card 3 /ΔΔΔΔΔΔ4.25.... ...ΔΔΔΔΔΔ6.00

Card 2 /ΔΔΔΔΔΔ2.25.... ...ΔΔΔΔΔΔ4.00

Card 1 /ΔΔΔΔΔΔ0.25 ΔΔΔΔΔΔ0.50... ...ΔΔΔΔΔΔ2.00

CARD TYPE 3 IMAGE(S)

Figure 3-3. Card Type 3 Input Format and Sample Card Image

3.2.4 Card Type 4

This card type inputs the number of personnel skill groups found in the organization. The specific skill groups will be entered using Type 5 cards. There are thirty-five skill groups (thirty-five cards) to be read in following this card.

Input formats and a sample card image appear in Figure 3-4.

CARD TYPE #4	NUMBER OF PERSONNEL SKILL GROUPS (ONE CARD)				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
1	1 - 5	I5	NTASKS(1)	Number of personnel skill groups to be analyzed.	3
	6 - 80	75X	——	Blank	Blank

/ 35....

CARD TYPE 4 IMAGE

Figure 3-4. Card Type 4 Input Format and Sample Card Image.

3.2.5 Card Type 5

Each card of this type contains the skill group name and the initial strength of that skill group. One card will be read in for each skill group. The total number of cards to be read is input by card type 4. (The example has thirty-five skill groups, so thirty-five type 5 cards are prepared). In order to minimize the discussion on this card type, only the first, twenty-fourth and last (thirty-fifth) cards are developed as examples. A maximum of ten characters can be used to name each skill group; abbreviations are often used.

Figure 3-5 contains the input format and sample card image for card types. The sample values used in the figure were obtained from Figure 2-3.

CARD TYPE #5	SPECIFICATION OF SKILL GROUP NAMES AND INITIAL STRENGTHS				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
1	1-10	2A4, A2	TASK(1,1,1) TASK(1,2,1) TASK(1,3,1)	First four characters of name Second four characters of name Last two characters of name	COMPANY CO
2	11-15	I5	REG (1,1)	Initial Strength	1
	16-80	65X	—	Blank	Blank
⋮	⋮	⋮	⋮	⋮	⋮
47	1-10	2A4, A2	TASK(24,1,1) TASK(24,2,1) TASK(24,3,1)	First four characters of 24th name Second four characters of 24th name Last two characters of 24th name	RIFLEMAN
48	11-15	I5	REG (24,1)	Initial Strength of 24th group	27
	16-80	65X	—	Blank	Blank
⋮	⋮	⋮	⋮	⋮	⋮
2* NTASKS (1)-1	1-10	2A4, A2	TASK(NTASKS (1),1,1) TASK(NTASKS (1),2,1) TASK(NTASKS (1),3,1)	First four characters of last name Second four characters of last name Last two characters of last name	ASST GNNR
2* NTASKS (1)	11-15	I5	REG (NTASKS(1),1)	Initial Strength of last group	2
	16-80	65X	—	Blank	Blank

Card 35 / ASSTΔGNNRΔΔΔΔΔ2

Card 24 /RIFLEMANΔΔΔΔΔΔ27

Card 1 / COMPANYΔCOΔΔΔΔ1

CARD TYPE 5 IMAGE

Figure 3-5. Card Type 5 Input Format and Sample Card Image

3.2.6 Card Type 6

Similar to card type 4, this card inputs the number of equipment types to be considered in the analysis. The specific equipment type input will be entered using card type 7. There are nineteen equipment types (nineteen cards) to be read in following this card.

Input formats and a sample card image appears in Figure 3-6.

CARD TYPE =6	NUMBER OF EQUIPMENT TYPES (ONE CARD)				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
1	1-5	I5	NTASKS(2)	Number equipment types to be analyzed.	19
	6-80	75X	—	Blank	Blank

```
...19....
```

CARD TYPE 6 IMAGE

Figure 3.6. Card Type 6 Input Format and Sample Card Image

3.2.7 Card Type 7

Each card of this type contains the name of the equipment type, the initial strength of the equipment type and the times (in minutes) to repair light and moderate damage sustained by the equipment type. The total number of cards to be read in is contained in card type 6. (The example has 19 equipment types, so 19 type 7 cards are prepared.) In order to minimize the preparation discussion on this card type, only the first, twelfth and last (nineteenth) cards are shown as examples. As with personnel skill titles, a maximum of ten characters are used to store each materiel title.

Figure 3-7 contains the input format and sample card image for card type 7. Sample values used in the figure were obtained from Figure 2-4.

CARD TYPE #7	SPECIFICATION OF EQUIPMENT TYPE NAMES, INITIAL STRENGTHS, AND REPAIR TIMES FOR LIGHT AND MODERATE DAMAGE (ONE CARD/TYPE).				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
1	1-10	2A4, A2	TASK(1,1,2) TASK(1,2,2) TASK(1,3,2)	First four characters of name Second four characters of name Last two characters of name	CO CARRIER
2	11-15	I5	REG (1,2)	Initial Strength	1
3	16-20	I5	REPTIM(1,1)	Minutes to repair light damage	60
4	21-25	I5	REPTIM(1,2)	Minutes to repair moderate damage	240
	26-80	55X	——	Blank	Blank
⋮	⋮	⋮	⋮	⋮	⋮
45	1-10	2A4, A2	TASK(12,1,2) TASK(12,2,2) TASK(12,3,2)	First four characters of twelfth name Second four characters of 12th name Last two characters of 12th name	1/4T W PLT
46	11-15	I5	REG(12,2)	Initial Strength of 12th type	2
47	16-20	I5	REPTIM(12,1)	Minutes to Repair light damage	45
48	21-25	I5	REPTIM(12,2)	Minutes to repair moderate damage	180
	26-80	55X	——	Blank	Blank
⋮	⋮	⋮	⋮	⋮	⋮
4* NTASKS (2)-3	1-10	2A4, A2	TASK(NTASKS (2),1,2) TASK(NTASKS (2),2,2) TASK(NTASKS (2),3,2)	First four characters of last name Second four characters of last name Last two characters of last name	RIFLE 5.56
4* NTASKS (2)-2	11-15	I5	REG(NTASKS (2),2)	Initial strength of last type	153
4 NTASKS (2)-1	16-20	I5	REPTIM(NTASKS (2),1	Minutes to repair light damage	15
4* NTASKS (2.	21-25	I5	REPTIM(NTASKS (2),2)	Minutes to repair moderate damage	60
	26-80	55X	——	Blank	Blank

Card 19/RIFLEΔ5.56ΔΔ153ΔΔΔ15ΔΔΔ60Δ.... /

Card 12/1/4TΔWΔPLTΔΔΔΔ2ΔΔΔ45ΔΔ180Δ.... /

Card 1 /COΔCARRIERΔΔΔΔ1ΔΔΔ60ΔΔ240Δ.... /

CARD TYPE 7 IMAGE(S)

Figure 3-7. Card Type 7 Input Format and Sample Card Image

3.2.8 Card Type 8

This card provides the input of the personnel transfer matrix. The sample case requires a thirty-five by thirty-five matrix. Since each card can only accommodate sixteen row values, each skill group for this example will require three cards. (The first through sixteenth value on the first card, the seventeenth through thirty-second value on the second card, and the thirty-third through thirty-fifth value on the third card.)

Figure 3-8 contains the input format and sample card images for the personnel transfer matrix. In order to shorten the summary table for card type 8, only the first row is shown (a total of 105 (3x35) cards are required). Note a "-1" is entered when a transfer is not permitted. Blank fields default to -1, which simplifies input of the transfer matrix. The sample data used here was obtained from Figure 2-6.

CARD TYPE # 8	PERSONNEL TRANSFER MATRIX (ONE SET OF CARDS/ROW: 16 VALUES/CARD) TIMES (MINUTES) FOR A ROW SKILL TO SUBSTITUTE FOR A COLUMN SKILL.				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
				The personnel matrix is an NTASKS(1) X NTASKS(1) matrix. If transfer is not permitted for a given element of the matrix, enter negative value. NOTE: <u>Blank entries are assumed negative values</u>. If the total time cost for a transfer is greater than or equal to the last time slice, the transfer is assumed non-feasible.	
1	1-5	I5	TRANP(1,1)	Transfer time row 1 to column 1.	0
2	6-10	I5	TRANP(1,2)	Transfer time row 1 to column 2.	0
3	11-15	I5	TRANP(1,3)	Transfer time row 1 to column 3.	0
. . .	. . .	. . .	. . .	. . .	. . .
16	76-80	I5	TRANP(1,16)	Transfer time row 1 to column 16 (last time this card).	-1
17	1-5	I5	TRANP(1,17)	Transfer time row 1 to column 17	0
. . .	. . .	. . .	. . .	. . .	. . .
32	76-80	I5	TRANP(1,32)	Transfer time row 1 to column 32 (last time this card)	0
33	1-5	I5	TRANP(1,33)	Transfer time row 1 to column 33	0
34	6-10	I5	TRANP(1,34)	Transfer time row 1 to column 34	10
35	11-15	I5	TRANP(1,35)	Transfer time row 1 to column 35 (last time this card because in sample case, NTASKS(1) = 35)	0

Card 3 /ΔΔΔΔ0ΔΔΔ10ΔΔΔΔ0.... /

Card 2 /ΔΔΔΔ0.... ...ΔΔΔΔ0/

Card 1 /ΔΔΔΔ0ΔΔΔΔ0ΔΔΔΔ0.... ...ΔΔΔ-1/
or (ΔΔΔΔΔ)

CARD TYPE 8 IMAGE(S)

Figure 3-8. Card Type 8 Input Format and Sample Card Image

3.2.9 Card Type 9

This card provides the input of the materiel transfer matrix. The sample case requires a nineteen by nineteen matrix. Since each card can only accommodate sixteen row values, each skill group for this example will require two cards. The input format for Card Type 9 is the same as Card Type 8, except that the number of cards required to input each row may differ.

CARD TYPE #9	MATERIEL TRANSFER MATRIX (ONE SET OF CARDS/ROW; 16 VALUES/CARD) TIMES (MINUTES) FOR A ROW TYPE TO SUBSTITUTE FOR A COLUMN TYPE				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUES
1-16			TRANM(NTASKS (2), NTASKS(2))	The materiel transfer matrix is an NTASKS(2)xNTASKS(2) matrix. This card set exactly parallels CARD TYPE 8 for each materiel line.	

CARD TYPE 9 IMAGE SAME AS CARD TYPE 8

Figure 3-9. Card Type 9 Input Format and Sample Image.

3.2.10 Card Type 10

This card type inputs the number of essential teams that comprise the organization and the number of missions to be analyzed. In the sample case, eighteen personnel and materiel teams and one mission are to be entered.

CARD TYPE = 10	NUMBER OF ESSENTIAL TEAMS AND NUMBER OF MISSIONS (ONE CARD)				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
				NOTE: All missions must be defined on the same set of available resources. Inventory items in excess of teams are spares.	
1	1-5	I5	NTEAMS	No. of teams	18
2	6-10	I5	NMISON	No. of missions to be considered.	1
	11-80	70X	--	Blank	

/␣␣␣18␣␣␣␣1 /

CARD TYPE 10 IMAGE

Figure 3-10. Card Type 10 Input Format and Sample Image

3.2.11 Card Type 11

This card type is used to input the requirements for essential teams. The personnel requirements for teams one through NTEAMS are entered first, followed by the requirements for the materiel teams. Entering the requirements is made easier by using a system which takes advantage of the typical team build. Team requirements tend to have runs of the same number. For example, the first essential personnel team of the example (Figure 2-13) does not require any of the first six personnel skills, but does require one of the seventh skill, the carrier driver on line number seven. So, the first essential team has a run of six zeros before a non-zero requirement is reached.

The technique used to enter the data is to have a two value input system where the first value denotes the number of times the second value is to be repeated in the array. The first value is a multiplication factor and the second value is the associated requirement. In the example cited above, multiplication factor No. 1 is six and requirement no. 1 is zero because the first six consecutive skill groups have a requirement of zero. The number of multiplication factors (and corresponding requirements) depends upon the build of each particular team. The sum of the multiplication factors for any team must equal the number of skill groups or equipment types.

Figure 3-11 contains the card format and sample card image for Card Type 11. Only the first essential personnel team is shown, although there are eighteen personnel and materiel essential teams. By using this input system, only ten items are entered, rather the thirty-five which would be necessary if each skill group required a value. The remaining personnel and materiel team requirements are entered similarly.

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CARD TYPE = 11	REQUIREMENTS FOR ESSENTIAL TEAMS ORDERED BY PERSONNEL AND MATERIEL WITHIN MISSION (NO. OF CARDS VARY BY DATA ITEMS 16 VALUES/CARD ONE SET/TEAM)				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
				NOTE: Blank or Zero multiplication factor entry is assumed to be one (1), therefore, all fields (16) on a card are read and used until all tasks are counted.	
1	1-2	I2	IPRND(1,1)	Multiplication Factor No. 1	6
2	3-5	I3	IPRND(1,2)	Requirement No. 1	0
3	6-7	I2	IPRND(2,1)	Multiplication Factor No. 2	1
4	8-10	I3	IPRND(2,2)	Requirement No. 2	1
5	11-12	I2	IPRND(3,1)	Multiplication Factor No.3	13
6	13-15	I3	IPRND(3,2)	Requirement No.3	0
7	16-17	I2	IPRND(4,1)	Multiplication Factor No.4	4
8	18-20	I3	IPRND(4,2)	Requirement No. 4	1
2M-1	. . .	I2	IPRND(M,1)	The Mth multiplication factor this card (maximum of 16 allowed)	11
2M	. . .	I3	IPRND(M,2)	Requirement No. M	0

/Δ6ΔΔ0Δ1ΔΔ113ΔΔ0Δ4ΔΔ111ΔΔ0

CARD TYPE 11 IMAGE

Figure 3-11. Card Type 11 Input Format and Sample Image

3.2.12 Card Type 12

For every PD set, this card type allows the input of up to eighty characters to title the AMORE output. The title of the sample case is "THE MECHANIZED INFANTRY COMPANY CONDUCTING THE ATTACK MISSION." This title contains sixty-two characters, including spaces between words. A good data processing habit is to center titles in given fields. Therefore the number of character spaces for the left and right margins would be (80-62)/ 2 = 9 characters each.

Figure 3.12 has the input format and sample card image for Card Type 12.

<table>
<tr><td>CARD TYPE # 12</td><td colspan="5">NAME OR DESCRIPTION (OFTEN BASED ON ASSOCIATED PD SET) THIS RUN OF PROGRAM AMORE (ONE CARD PER SET OF PERSONNEL AND MATERIEL PDs)</td></tr>
<tr><td>ITEM</td><td>CARD COLUMN</td><td>FORTRAN FORMAT</td><td>FORTRAN VARIABLE</td><td>DESCRIPTION</td><td>SAMPLE VALUE</td></tr>
<tr><td>1</td><td>1-80</td><td>20A4</td><td>TITLE(20)</td><td>Twenty, four character elements allowing 80 characters of alphabetic title information; one title card must precede each PD set.</td><td>As in text</td></tr>
</table>

/△△△△△△△△△THE△MECHANIZED△INFANTRY△COMPANY△CONDUCTING△THE△ATTACK△MISSION

CARD TYPE 12 IMAGE

Figure 3-12. Card Type 12 Input Format and Sample Image

3.2.13 Card Type 13

This card type inputs the probability of degradation (PD) for particular personnel skill groups and the delay time in minutes for the commander's decision. An examination of the PD set shown in Figure 2-16 reveals that there are four different probabilities of degradation for personnel (0.13, 0.14, 0.15 and 0.18). A type 13 card for each of these PDs (containing the line numbers for all personnel skill groups with that PD) will be prepared. The commander's decision time for personnel is included on each card.

Figure 2-13 contains the input format and sample image for card type 13. An example using a PD of 0.15 is shown in the figure. Each card can accommodate a maximum of 14 personnel line numbers, along with the PD and decision time. Note that two cards would be required to input the PD of 0.13 which applies to seventeen different skill groups. Note also that if a single PD and decision time applies to all skill groups, then only one card (with an entry of -1 for the first line number) is required.

CARD TYPE # 13	DEGRADATION PROBABILITIES AND DELAY TIMES FOR PERSONNEL BY SKILL GROUPS (ONE SET OF CARDS; 16 VALUES/CARD)				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
1	1-5	F5.0	TEMPPD(1)	Probability of Degradation (PD) for personnel skill groups to follow (real no. $\leq$ 1.0)	0.15
2	6-10	I5	ITEMPD	Personnel commander's decision (delay) time (min.) to assess damage and initiate recovery actions	5
3	11-15	I5	INDEX(1)	Line number of first personnel skill group having this PD (Note: if this PD applys to all skill groups, enter -1 in columns 14-15)	1
4	16-20	I5	INDEX(2)	Line number of second skill group	10
5	21-25	I5	INDEX(3)	Line number of third skill group	15
6	26-30	I5	INDEX(4)	Line number of fourth skill group	16
. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
16	75-80	I5	INDEX(14)	Last line number this card. If continuation cards are needed, they must repeat the PD and delay time.	

/△0.15△△△△5△△△△1△△△10△△△15△△△16

CARD TYPE 13 IMAGE

Figure 3-13. Card Type 13 Input Format and Sample Card Image

3.2.14 Card Type 14

This card type, similar to card type 13, inputs the PDs for particular equipment types, and the delay time in minutes for the commander's decision. As discussed in section 2.2.3, the PD set for materiel contains PDs for light, moderate and severe damage and the commander's decision time. The PD's are in the cumulative format.

Figure 3-14 contains the input formats for card type 14. In addition, a sample card image with the cumulative PDs of 0.30, 0.22 and 0.08 is shown. The commander's decision time is ten (10) minutes for all equipment types. For materiel PD sets, a maximum of twelve line numbers can be input on each card. As with personnel, a -1 as the first line number indicates that the PD's and decision time apply to all equipment types.

CARD TYPE # 14	DEGRADATION PROBABILITIES AND DELAY TIMES FOR MATERIEL BY EQUIPMENT TYPE (ONE SET OF CARDS; 16 VALUES/CARD)				
ITEM	CARD COLUMN	FORTRAN FORMAT	FORTRAN VARIABLE	DESCRIPTION	SAMPLE VALUE
1	1-5	F5.0	TEMPPD(1)	Probability of light (or greater) damage (PD) to the equipment types with line numbers entered on this card	.30
2	6-10	F5.0	TEMPPD(2)	PD for moderate (or greater) damage	.22
3	7-15	F5.0	TEMPPD(3)	PD for severe damage	.08
4	16-20	I5	ITEMPD	Materiel Commander's decision (delay)	10
5	21-15	I5	INDEX(1)	Line number of first equipment type for this PD (<u>NOTE</u>: If this PD applies to all equipment types, enter -1).	1
6	16-20	I5	INDEX(2)	Line number of second equipment type	7
. . . .	. . . .	. . . .	. . . .	. . . .	. . . .
16	76-80	I5	INDEX(12)	Last line number this card	--

/Δ0.30ΔΔ.22Δ0.04ΔΔΔ10ΔΔΔΔ1ΔΔΔΔ7

CARD TYPE 14 IMAGE

Figure 3-14. Card Type 14 Input Format and Sample Card Image

3.3 PROGRAM EXECUTION

As with any computer program, program AMORE must be prepared and organized to adhere to certain sequential rules and specifications in order to properly execute on a specific computer. To do this, the user issues instructions to the computer via punched cards (batch mode) or remote terminal (time sharing mode). A sample of the UNIVAC required runstream is shown in Figure 3-15. The runstream is simple

```
@RUN, [/options] [run-id, account, project-id, run-time/
                  deadline, pages/cards, start-time]
@ASG,A ProgramFile.
@ASG,A DataFile.
@ASG,T 10
@XQT   ProgramFile.Abs
@ADD   DataFile.Element
@FIN
```

Figure 3-15. Sample AMORE Runstream

and is generally self-explanatory. Note the requirement for a unit 10. designated scratch file. This file is used during input processing and during processing of alternate optimal solutions. It is not needed after the run is completed and is therefore assigned as a temporary file.